Engineering Library

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The Engineer.

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VOL. CXLIV.—No. 3749] LONDON: FRIDAY EVENING, NOVEMBER 18, 1927 [PRICE ONE SHILLING BY INLAND POST 1s. 3d.

PUBLIC NOTICES

R.A. 2522.

Ministry of Transport.
ARTERIAL ROADS, GREATER LONDON.
NORTH CIRCULAR ROAD—WALTHAMSTOW.
EPPING FOREST SECTION.

The Minister is prepared to receive TENDERS for CONSTRUCTIONAL, SURFACING and OUTFALL DRAINAGE WORK in connection with the Epping Forest Section of the North Circular Arterial Road, Walthamstow, Essex.

Form of Tender, conditions of Tender, conditions of contract, bill of quantities and specification may be obtained from the Chief Engineer, Roads Department, Ministry of Transport, 7, Whitehall-gardens, S.W. 1, upon payment of a deposit of £25.

This amount will be returned to the tenderer if his Tender is a bona fide one and has not been withdrawn prior to the definite acceptance of a Tender by the Minister.

The drawings may be inspected at the offices of the Ministry, and copies of the Tender documents will be available on and after Friday, 25th November, 1927.

Tenders on the official form, accompanied by a fully priced bill of quantities and schedules of prices, and enclosed in a sealed envelope, endorsed "Tender for Construction and Surfacing, North Circular Road, Essex," must reach the Assistant Secretary, Roads Department, Ministry of Transport, 7, Whitehall-gardens, S.W. 1, by 10 a.m. on Friday, the 9th December, 1927.

The Minister does not bind himself to accept the lowest or any Tender.

Dated this 7th day of November, 1927.

H. H. PIGGOTT,
6955 Assistant Secretary.

Assistant Engineer Required by the KENYA and UGANDA RAILWAY for the CONSTRUCTION DEPARTMENT. Salary £600 a year. Outfit allowance of £30 on first appointment. Free quarters and passages and liberal leave on full salary. Candidates, age 23 to 35, should have had experience on Railway Construction. Preference will be given to Associate Members of the Institution of Civil Engineers.—Apply at once by letter, stating age, qualifications and particulars of experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, S.W. 1, quoting M/158. 7026

Assistant Engineers (5) REQUIRED by the GOVERNMENT of NIGERIA for the PUBLIC WORKS DEPARTMENT for two tours of not less than 12 nor more than 18 months' service in the first instance. Subject to satisfactory service the officers appointed will be eligible at the expiration of three years' service for confirmation in the permanent and pensionable establishment. Salary £480, rising to £920 a year. Outfit allowance of £60 on first appointment. Free quarters and passages and liberal leave on full salary. Candidates, preferably between 25 and 35 years of age, must have passed the examination for A.M.I.C.E., or possess a degree in Civil Engineering recognised by the Institution as exempting from parts "A" and "B" of the examination. Must have had proper technical training and preferably have had not less than two years' subsequent experience on large Engineering or Municipal works.—Apply at once by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, S.W 1, quoting M/254. 6938

District Engineers (2) REQUIRED for the NIGERIAN RAILWAY (Capital Works) for a tour of 12 to 18 months' service, with possible extension. Salary £720, rising to £920 a year by annual increments of £40. Free quarters and passages and liberal leave on full salary. Candidates, not over 45 years of age and preferably A.M. Inst. C.E., should have had responsible charge of Railway Construction.—Apply at once by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/219. 7027

Experienced Steelwork DRAUGHTSMAN REQUIRED in the Office of the Crown Agents for the Colonies. Wide experience in the design of Bridges, Workshops, Buildings, &c., and of Stress Calculations essential. Commencing salary £250 per annum, rising by annual increments of £15 to £350 per annum, plus Civil Service bonus, which at present amounts to £111 on £250 and £135 on £350.—Apply in writing to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, S.W. 1, stating fully technical training, experience, age, &c., and quoting "O/Sec. Office 154." 7055

Required by the GOVERNMENT of NIGERIA for Road Survey and Construction Work:—SIX ASSISTANT ENGINEERS (Reference M/15093).

Salary £480 for three years, then £510 rising by annual increments to £920. Outfit allowance of £60 payable on first appointment. Candidates should have had good experience on Road and Bridge or Railway Survey and Construction.

THREE FOREMEN OF WORKS (Reference M/15071).

Salary £400, rising by annual increments of £12 to £500. Outfit allowance of £45 payable on first appointment. Candidates should have had good experience of Public Works, preferably on Road or Railway Construction.

The period of engagement is for two tours, each of 12 to 18 months' service, with possible extension. Free passages, quarters and liberal leave on full salary after each tour of service. Age not to exceed 42 years.—Apply at once by letter, stating age and particulars of qualifications and experience, marking the envelope and letter with the number shown against the class of vacancy for which application is made, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1. 7043

The Government of CEYLON invite APPLICATIONS for a CHIEF ENGINEER to take immediate charge of and responsibility for the Government's Electrical Undertakings. The Government have under construction a steam generating station, and a system of distribution in Colombo, and also hydro-electric power works designed to supply Colombo and districts in the first instance, afterwards to be extended for general supply purposes. Qualifications desired:—Good administrative ability, experience of Power Distribution in Urban and Rural Districts, Hydro-electric Power Construction. Period of engagement 3 or 5 years in first instance. Free quarters will be provided in Colombo. Government will pay cost of ocean passage to Ceylon of selected candidate and family. Candidates to state age, qualifications, experience, and salary required.—Applications to be forwarded on or before the 1st February, 1928, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W.1. 7025

The Engineer

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PUBLIC NOTICES

Armstrong College,
NEWCASTLE-UPON-TYNE.
(IN THE UNIVERSITY OF DURHAM.)

COURSES for the PASS DEGREE of B.Sc. and the HONOURS DEGREE of B.SC. in MECHANICAL, MARINE, CIVIL or ELECTRICAL ENGINEERING, MINING, METALLURGY, or NAVAL ARCHITECTURE. The curricula of the Pass Degree and the Honours Degree normally occupy periods of three and four years respectively, but candidates presenting evidence of sufficient previous training may be allowed to proceed to either Degree after two years' residence.

The engineering laboratories have recently been extended, and all Departments are equipped for advanced tutorial and research work.

Full particulars of the Courses may be had on application to

THE REGISTRAR,
Armstrong College,
6627 Newcastle-upon-Tyne.

Armourers and Brasiers' COMPANY.
LECTURES IN METALLURGY.

The Company have arranged for the following Lectures to be delivered:—

At the Royal School of Mines, Prince Consort-road, South Kensington, at 5.15 p.m., on the 8th, 15th, and 22nd November, 1927, by G. Shearer, Esq., M.A., D.Sc., on "X-RAYS AND METALS."

At the Chelsea Polytechnic, Manresa-road, S.W., at 8 p.m., on the 30th November, 7th and 14th December, 1927, by Professor Cecil H. Desch, D.Sc., Ph.D., F.R.S., F.I.C., on "THE DEFORMATION OF METALS."

Admission free, without ticket. 6816

PUBLIC NOTICES

Crystal Palace School of Practical Engineering.
Founded 1872.
MECHANICAL AND CIVIL ENGINEERING DIVISIONS.
PRESIDENT: J. W. WILSON, M.I.C.E., M.I.M.E.
PRINCIPAL: MAURICE WILSON, M.I.C.E.

Assisted by Staff of Lecturers and Instructors. Thorough, up-to-date Practical and Theoretical Instruction. Course completed in 2 years. Students admitted at beginning of any term. 6842

Loughborough College,
LEICESTERSHIRE.

DEPARTMENT OF MECHANICAL AND CIVIL ENGINEERING.

Consequent upon the appointment of Mr. L. W. Kershaw as Principal of the College of Technology, Leicester, the GOVERNORS invite APPLICATIONS for the POST of HEAD of the above DEPARTMENT.

Candidates should be Graduates of a University in the United Kingdom, and in addition to having had practical experience in industry, they should possess special qualifications in Civil Engineering.

The Departmental Scale of Salary is £450, rising by increments of £24 to £650 per annum, and in assessing the commencing point on the Scale the Governors will take note of the candidate's previous experience.

Forms of application and particulars of the duties may be obtained from the Registrar upon receipt of a stamped addressed envelope. These, with at least three recent testimonials, should be returned to the PRINCIPAL not later than Thursday, the 24th November. 7019

Bombay, Baroda and Central INDIA RAILWAY COMPANY.

The Directors are prepared to receive up to Noon on Friday, 9th December, TENDERS for the SUPPLY of:
1. LATHES.
2. FOUR-WHEELED PETROL TANK WAGONS.
3. STEEL MATERIAL (PLATES, CHANNELS, FLATS, &c.).

Tenders must be made on forms, copies of which, with specification, can be obtained at these offices on payment of £1 each for No. 1 and 10s. each for Nos. 2 and 3 (which will not be returned).

The Directors do not bind themselves to accept the lowest or any Tender.

S. G. S. YOUNG,
Secretary.

Offices: The White Mansion,
91, Petty France, Westminster, S.W. 1,
16th November, 1927. 7051

PUBLIC NOTICES

County Borough of Oldham.
ELECTRICITY DEPARTMENT.

The Electricity Committee of the Oldham Corporation are prepared to receive TENDERS for the SUPPLY, DELIVERY, and LAYING of the following in connection with their New Power Station, Slacks Valley, Chadderton, near Oldham:—

CONTRACT NO. 10.

The SUPPLY, DELIVERY, and LAYING of RAILWAY SIDINGS for the first section of a New Power Station at Slacks Valley, Chadderton, near Oldham.

Specifications prepared by Mr. R. Blackmore, A.M.I.E.E., Consulting Engineer, may be obtained on application to Mr. F. L. Ogden, Borough Electrical Engineer, Greenhill Electricity Offices, Oldham.

A deposit of One Guinea for each copy of the specification must accompany the application, which deposit will be refunded on receipt of a bona fide Tender.

Tenders, endorsed "Railway Sidings," are to be addressed to the Chairman of the Electricity Committee and delivered at the Greenhill Electricity Offices, Oldham, not later than Saturday Noon, 3rd December, 1927.

The complete plant for this section of the works will be placed with one contractor.

The Corporation do not bind themselves to accept the lowest or any Tender.

JOSEPH J. WILLIAMS, L.L.M.,
Town Clerk.

Town Hall, Oldham,
15th November, 1927. 7038

County of London.
RECONSTRUCTION OF BEVERLEY BRIDGE.

The London County Council invites TENDERS for the RECONSTRUCTION and WIDENING of BEVERLEY BRIDGE carrying Kingston-road over Beverley Brook.

The specification, form of Tender, &c., may be obtained on application to the Chief Engineer of the Council upon payment of the sum of £2 by cheque or draft to the order of the London County Council. This amount will be returnable only if the tenderer shall have sent in a bona fide Tender and shall not have withdrawn the same. Full particulars of the work may be obtained upon personal application, and the contract documents may be inspected before payment of the fee.

Correspondence and remittances by post should be addressed to the Chief Engineer at the Old County Hall, Spring-gardens, S.W. 1, or if personal application is made, applicants should apply in Room 9A at No. 3, Warwick House-street, Cockspur-street, S.W. 1.

The contractor will be bound to observe the provisions of a fair wages clause, the terms of which are set out fully in the instructions for Tender and form of contract and in the "London County Council Gazette."

No Tender received by the Clerk of the Council at the County Hall, Westminster Bridge, S.E. 1, after 4 p.m. on Monday, 5th December, 1927, will be considered.

The Council does not bind itself to accept the lowest or any Tender.

MONTAGU H. COX,
7024 Clerk of the London County Council.

Manchester Corporation.

The Rivers Committee invite TENDERS for the CONSTRUCTION of MOSS SIDE and WHALLEY RANGE DRAINAGE NEW RELIEF SEWERS, Brantingham-road, Stamford-road and Platt-lane, between Manchester-road and Upper Lloyd-street; and in Wood-road and College-road, between Upper Chorlton-road and Victoria-road.

Plans may be seen and specifications, bills of quantities and forms of Tender obtained on application at the City Engineer's Office, Town Hall, Manchester, on payment to the City Treasurer of £5 5s., which sum will, after the Corporation have come to a decision upon the Tenders received, but not before, be returned to the person submitting a bona fide Tender.

All cheques or postal orders are to be made payable to the order of "The Corporation of Manchester."

Tenders, enclosed in the official envelope and addressed to the Chairman of the Rivers Committee, are to be delivered at the City Engineer's Office not later than 9.30 a.m. on Wednesday, the 7th December, 1927.

The Corporation do not bind themselves to accept the lowest or any Tender.

P. M. HEATH,
Town Clerk.

Town Hall, Manchester,
10th November, 1927. 7013

The Madras and Southern MAHRATTA RAILWAY COMPANY, Limited, 25, Buckingham Palace-road, Westminster, S.W. 1, invite TENDERS for:—

(1) 2050 TONS (Approx.) STEEL MATERIAL (M.S. Squares, Channels, Flats, Rounds, Plates and Sheets).
(2) 164 TONS (Approx.) GALVANISED STEEL or IRONWORK (Corrugated and Plain Sheets).

Tenders are due in on Tuesday, 6th December, 1927, by 2 p.m. Tender forms obtainable at above address; fee One Guinea each, which is not returnable.

The Directors do not bind themselves to accept the lowest or any Tender. 7021

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PUBLIC NOTICES

Hayfield Rural District Council,
DERBYSHIRE.

The above Council invite TENDERS from responsible contractors for the CONSTRUCTION and COMPLETION of an EXTENSION to the present MAIN DRAINAGE SYSTEM of the Hayfield Parish.

The proposed works comprise the following:—About 600 Lineal Yards of Stoneware Pipe Sewer, 9in. in diameter; 33 Lineal Yards of Cast Iron Ditto Ditto under the bed of the River Sett, with all Manholes, Lampholes, Flushing Tanks, Ventilators, Connections, &c.

Plans and specification may be seen by appointment at the office of the District Surveyor, Hayfield, and copies of the bills of quantities and form of Tender may be obtained from him or from the Engineer, Mr. G. Herbert Bayley, M. Inst. C.E., No. 7, Sparth-lane, Stockport, on deposit of One Guinea, which will be returned on receipt of a bona fide Tender not afterwards withdrawn and/or the return of all the documents.

Constructors proposing to Tender are requested to send their names (by post) to the Engineer on or before the 26th inst.

Sealed Tenders, endorsed "Tender for Kinder-road Sewer," are to be delivered to me at the Rural District Council Offices, 16, High-street, New Mills, on or before Saturday, the 10th day of December, 1927.

The Council do not bind themselves to accept the lowest or any Tender.

(Signed) J. R. BOWDEN,
Clerk to the Council.

Council Offices,
16, High-street, New Mills. 7031

Shoreditch Board of Guardians.

The Guardians invite TENDERS for the INSTALLATION of a HOT WATER HEATING SYSTEM at their Cottage Homes, Hornchurch, Romford, Essex.

Copies of the specification may be obtained and drawings inspected on application to the undersigned on any week-day (except Saturday) between the hours of 10 a.m. and 4 p.m.

Persons tendering will be at liberty to submit alternative schemes if they so desire.

Sealed Tenders must be delivered to me by Tuesday, the 29th November, 1927.

The Guardians do not pledge themselves to accept the lowest or any Tender.

By Order,
JNO. C. CLAY,
Clerk to the Guardians.

213, Kingsland-road, London, E. 2,
15th November, 1927. 7039

South Indian Railway Company,
LIMITED.

The Directors are prepared to receive TENDERS for the SUPPLY of:—

1. POINTS and CROSSINGS, &c.
2. PRESSED STEEL SLEEPERS.
3. DOG SPIKES, FISH BOLTS, NUTS and WASHERS.
4. STEEL BEARING PLATES for F.B. RAILS.
5. CYLINDRICAL BUFFERS.

Specifications and forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W. 1.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tender for Points and Crossings, &c.," or as the case may be, must be left with the undersigned not later than Twelve Noon on Friday, the 2nd December, 1927.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of £1 for each copy of Specifications Nos. 1 and 2, and of 10s. for each copy of Specifications Nos. 3, 4, and 5.

Copies of the drawings may be obtained from the offices of the Company's Consulting Engineers, Messrs. Robert White and Partners, 3, Victoria-street, Westminster, S.W. 1.

A. MUIRHEAD,
Managing Director.

91, Petty France, Westminster, S.W. 1,
16th November, 1927. 7061

The Walsall and West Bromwich
UNIONS JOINT COMMITTEE.
GREAT BARR PARK COLONY.
TO ELECTRICAL AND HEATING ENGINEERS.

The above Committee are prepared to receive TENDERS for the following, viz.:—

(1) BOILERS and ACCESSORIES.
(2) PUMP HOUSE and MAINS.
(3) HEATING and HOT WATER SERVICES in each of 12 Blocks of Buildings (separate specification and Tender for each Block).
(4) ELECTRIC MAINS and CONNECTIONS.
(5) ELECTRIC WIRING the whole of 12 Blocks of Buildings.
(6) ENGINEERS' MACHINE TOOLS, SHAFTING and ACCESSORIES.

In accordance with plans and specifications to be seen at the offices of the Consulting Engineers, Messrs. Edwards and Shaw, of 105, Colmore-row, Birmingham, between the hours of 10 a.m. and 1 p.m.

Firms desirous of tendering for any or all of the items are requested to notify me which items they desire to Tender for and to send me deposit fee of £5 5s. not later than the 23rd November, 1927. The amount deposited will be returned by cheque after Tenders have been considered.

Copies of schedule of prices, specifications or plans, as the case may be, and forms of Tender will be sent out as soon as possible after that date.

Tenders for Heating and Hot Water Services in the Nurses' Home, Unimprovable Block, Two New Homes for Mental Defectives, and Electric Wiring of the Blocks, specifically endorsed, must be received by me not later than 10 a.m. on Wednesday, the 30th November.

The date upon which Tenders for the remaining portion must be received will be notified when schedule of prices, &c., are forwarded. Each Tender must be specifically endorsed.

The Committee reserve the right to let the whole of the works in one contract or to subdivide the work.

The Committee do not bind themselves to accept the lowest or any Tender.

By Order,
A. H. WARD,
Clerk.

22, Lombard-street, West Bromwich,
10th November, 1927. 7014

Urban District Council of
NEWRY.
NOTICE TO BRIDGE BUILDERS.

TENDERS FOR NEW STEEL SWING BRIDGE.

The Urban District Council of Newry invite TENDERS for the CONSTRUCTION of a NEW SINGLE-LEAF STEEL SWING BRIDGE over the canal at Godfrey Bridge, Newry. Full particulars regarding design, alterations and additions to abutments and plan of site can be obtained from Mr. C. Blaney, Town Surveyor, Town Hall, Newry, on payment of the sum of £1 1s., which will be refunded to contractors who submit a bona fide Tender.

The price and all other things being equal, a preference shall be given to contractors employing exclusively trades union labour under trades union conditions and also to those undertaking to employ local fitters in the erection of the bridge at the site.

Contractors will be required to provide at their own expense a bond from an approved Insurance Company or Guarantee Society for the due fulfilment of the contract, and a letter must accompany the Tender from the Insurance Society or Company proposed undertaking to supply the required bond.

The Council desire that the contract for the construction and erection of the bridge should be completed on or before 31st March, 1928, and contractors shall state in their Tenders if they are prepared to undertake same.

Designs and specifications should be delivered to the Town Surveyor on or before 7th December next, and sealed Tenders addressed to the Chairman, Urban District Council, Town Hall, Newry, and endorsed "Tender for Steel Swing Bridge," will be received up to the 10th December, 1927.

The Council shall have the right to accept any Tender provisionally subject to the approval of the Ministry of Home Affairs, N.I.

The Council shall not be bound to accept the lowest or any Tender.

Dated this 8th day of November, 1927.

By Order,
W. M. CRONIN,
Town Clerk.

Council Offices,
Town Hall, Newry. 6993

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LONGMANS, GREEN & CO., Ltd., 39, Paternoster Row, LONDON, E.C.4.

PUBLIC NOTICES

West Ham Union.

The Guardians invite TENDERS for the CARRYING OUT of certain ELECTRICAL REPAIR WORK at their Forest Gate Sick Home, 95, Forest-lane, Forest Gate, E. 7. Specification, with which intending contractors must comply, may be obtained from the CLERK to the GUARDIANS, Board Room, Union-road, Leytonstone, E. 11, and Tenders must be delivered at that office not later than 10 a.m. on Thursday, the 1st December, 1927. 7052

The Manchester Steam Users'
ASSOCIATION.

Mr. C. E. Stromeyer is retiring from the position of CHIEF ENGINEER next March after 30 years' service, and the Executive Committee invite APPLICATIONS to fill the VACANCY.

Only those possessing the highest qualifications and capable, by education and training, of conducting the whole of the Association's affairs, should apply.

Applications, stating age and giving full particulars of career and references (not testimonials), should be addressed to the EXECUTIVE COMMITTEE of the ASSOCIATION, 9, Mount-street, Albert-square, Manchester, by December 6th. 7018

Civil Service Commission.
POSITION VACANT.

The Civil Service Commissioners invite APPLICATIONS from experienced Motor Engineers for the permanent and pensionable POST of INSPECTOR of MECHANICAL TRANSPORT in the Stores Branch of the Department of Posts and Telegraphs; workshop experience essential. Remuneration £150 by £7 10s. to £210 per annum plus cost-of-living bonus. Bonus at present on £150 is £88 10s. Age limits 25 to 45 years. Latest date for receiving applications is 26th November, 1927.

Forms and particulars may be obtained from the SECRETARY, Civil Service Commission, 53, St. Stephen's Green, Dublin.

22/S.2173. W.H.Co. 7017

North Riding of Yorkshire
COUNTY COUNCIL.
HIGHWAYS AND BRIDGES COMMITTEE.
APPOINTMENT OF DIVISIONAL SURVEYOR.

APPLICATIONS are INVITED from duly qualified persons for the APPOINTMENT of DIVISIONAL SURVEYOR to take charge of a Division of Roads and Bridges under the County Surveyor.

Applicants must not be more than 35 years of age and must be prepared to pass a medical examination. The salary will be £300 per annum, rising by £15 per annum to £360, together with travelling allowance, subject to revision, but which at present is £320 per annum. The successful candidate will be required to provide and maintain a suitable motor car.

The office is an established post for the purpose of the Superannuation Act, 1922, and a deduction of 5 per cent. will be made from the salary.

Applications on the forms to be obtained from the undersigned are to be delivered not later than 3rd December, 1927, addressed to "The County Surveyor, County Hall, Northallerton," endorsed "Divisional Surveyor."

HUBERT G. THORNLEY,
Clerk of the County Council.

County Hall, Northallerton,
16th November, 1927. 7058

PUBLIC NOTICES

Madras and Southern Mahratta
RAILWAY CO., LTD.
VACANCY FOR OFFICER IN STORES DEPT.

WANTED, ASSISTANT CONTROLLER of STORES, age 30 to 32 years, must have good educational qualifications, combined with commercial training, have a good knowledge and previous experience of Railway Stores procedure, Stores Purchase Rules, and be a trained correspondent.

Desirable knowledge: Mechanical Engineering, Shipping Law, and Marine Insurance, Indian Law and Court Procedure.

SALARY.—Rs. 500 to Rs. 600 plus £25 per month, according to qualifications, with increases on promotion. Required in India immediately.

TERMS.—Subject to a strict medical examination by the Company's Consulting Physician, a three years' agreement in the first instance, a first-class free passage to India and home again on satisfactory termination of agreement, which is extensible by mutual consent. Employes are required to subscribe one month's pay yearly to the Company's Provident Fund, and to those of over five years' service a bonus equal to their contribution is credited, both bonus and contribution accumulating at compound interest until retirement.

Applications, with copies (not originals) of testimonials, should be made by letter only and addressed to the undersigned not later than 3rd December, 1927. Details must be given in chronological order with dates of general and technical education and practical experience, if any. Special forms of application will be sent to candidates who appear to have the necessary qualifications.

By Order,
C. L. MAGNIAC, Brig.-General,
Secretary.

25, Buckingham Palace-road,
Westminster, S.W. 1,
16th November, 1927. 7062

Western Australia.

An experienced LOCOMOTIVE DRAUGHTSMAN is REQUIRED by the Western Australian Government Railways.

Applicants must be fully qualified Locomotive Draughtsmen, with workshops practice and actual experience in the designing of the latest types of locomotives.

Age not to exceed 35 years.

Commencing salary £398 per annum, rising to £428 by two annual increments of £15.

The appointment, which will be for a period of three years, subject to renewal by mutual arrangement, is also subject to the Rules and Regulations and Salaried Staff By-law of the Western Australian Government Railways and the conditions and privileges of the Railway Salaried Officers' Award.

The successful applicant will require to take up duties at Midland Junction, Western Australia, within four months from date of selection.

Second-class fare by mail steamer will be allowed to Western Australia and half-pay on voyage from date of sailing until arrival in Western Australia.

Written applications, accompanied by medical certificate, testimonials and certificate or statutory declaration as to date of birth and nationality, setting forth concisely the technical qualifications, general education, age, and experience of applicant, stating also whether married or single, will be received by the

AGENT-GENERAL FOR WESTERN AUSTRALIA,
Savoy House,
115/116, Strand, London, W.C. 2,
up to the 31st December, 1927. Applications should be marked "Locomotive Draughtsman." 7050

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

HANS RENOLD, Ltd., THANK all APPLICANTS for POSITION as Engineer for Foreign Sales Department, and wish to state that the VACANCY has been FILLED. 7036 A

WANTED, ASSISTANT WORKS MANAGER for a progressive works. Must be very energetic and a good organiser and capable of handling men; 7.30 a.m. mnn.—Apply by letter only, giving full particulars as to age, experience, to whom reference can be made, and salary required, to J. and H. McLAREN, Ltd., Midland Engine Works, Leeds. 6998 A

WANTED by Engineering Firm of Standing, a Very Smart MAN as REPRESENTATIVE. Must be good Engineer and well up in Mechanical Handling Problems, Conveyors, Elevators, &c.—Address, giving age, qualifications and salary expected, 7032, The Engineer Office. 7032 A

WANTED, Capable Young ACCOUNTANT, to Take Charge of Costs and Statistics in Engineers' Office. Good prospects.—Apply, stating age, full details of experience and salary required, to "ENGINEER," c/o Wykes and Co., Chartered Accountants, Leicester. P3906 A

WANTED, CONSULTING MARINE ENGINEER or NAVAL ARCHITECT, experienced with Duraluminium Metal Constructions, with a knowledge of German preferred, to act as Consultant Inspector during building of boat.—Address, 7020, The Engineer Office. 7020 A

WANTED, ELECTRICAL ENGINEER, with Knowledge of Cinematograph Projector Machinery.—Address, stating experience, age, and salary required, P3893, The Engineer Office. P3893 A

WANTED, to Fill a Vacancy Caused by the Death of one of the directors, a thoroughly qualified and keen MAN of BUSINESS to take an active share as DIRECTOR in an old-established firm of Heating Engineers and Horticultural Builders in the Midlands. Full-time occupation with good remuneration. Only those who are prepared to take an active part and have had practical experience in Central Heating and Building Construction and the preparation of estimates will be considered. Applicant receiving appointment will be required to purchase an agreed number of shares. State age, experience, and give references.—Address, 6988, The Engineer Office. 6988 A

AN Old-established FIRM of LOCOMOTIVE ENGINEERS REQUIRE the SERVICES of an ASSISTANT SECRETARY, with probable succession to the senior position in 2 years.

Applicants should state, in confidence, age, present employment, salary expected, and full particulars of experience in accountancy, secretarial and commercial work.

Address, 7012, The Engineer Office. 7012 A

ASSISTANT CIVIL ENGINEERS REQUIRED for important British-owned Railway in Argentina. Candidates to have had previous railway experience on construction or maintenance and to have passed at least Parts "A" and "B" of Inst. C.E. exam. or hold exempting degree. Age 22-30; three years' contract. Salary £450/£550 plus £50 when knowledge of Spanish acquired.—Send full particulars education, training, experience, age, with copies (only) testimonials, to Box V. B., Davies, 95, Bishopsgate, E.C. 2. 7023 A

ASSISTANT to WORKS MANAGER WANTED by Engineering Firm on N.E. Coast engaged on constructional work, principally Gasworks Plant, Oil Installations and General Engineering. Smart young man with some knowledge of engineering to act as Assistant to Works Manager.—Address, stating age, experience, and salary required, 6980, The Engineer Office. 6980 A

BLAST-FURNACES.—WANTED, ASSISTANT to MANAGER. Young man with good engineering training preferred.—Address, giving full details and salary required, 6989, The Engineer Office. 6989 A

ENGINEERING SALESMAN REQUIRED for Calcutta Office. Good address, engineering qualifications and previous selling experience essential. Commencing salary Rs. 550 per month. Age not over 26, unmarried.—Write, Box No. 337, c/o Judd's, 47, Gresham-street, London, E.C. 2. 7045 A

HIGH-GRADE STEEL TRADE.—REPRESENTATIVE REQUIRED for Lancashire and part of Yorkshire. Must be thoroughly experienced and have established a connection in this ground for high grade steels. The position is an important one, and only applicants giving full particulars of their previous experience can be considered. Salary, expenses and commission will be paid to successful applicant.

Replies, which will be treated in strict confidence, to be addressed to ERNEST PENN, 70, Pall Mall, London, S.W. 1. P3891 A

INDIA.—ASSISTANT WORKS MANAGER REQUIRED by a British Firm who have structural steel and general engineering works. Mechanical and electrical experience required. Must be good organiser, used to control of men. Good salary and prospects; age under 35.—Address, sending full particulars, P3900, The Engineer Office. P3900 A

MECHANICAL ENGINEER, with Sound Commercial and sales experience, 25 to 30 years of age, unmarried, A.M.I.M.E. examination or equivalent REQUIRED for Sales Department of Rubber Manufacturing Firm in Federated Malay States.—Write Box No. 338, Judd's, 47, Gresham-street, London, E.C. 2. 7046 A

REQUIRED for India (Bombay District), an ASSISTANT ENGINEER for supervising the erection of the electrical equipment of a 40,000-kW Generating Station and a number of 100,000-volt outdoor Sub-stations. Candidates should have had experience of similar work.—Apply in writing, giving full particulars of age, experience, salary required, &c., to MERZ and PARTNERS, 32, Victoria-street, London, S.W. 1. 7016 A

SALESMAN, for Grinding Wheels, in Manchester and Midlands; must have had experience, and preferably a connection in that district.—Address, 7015, The Engineer Office. 7015 A

STRUCTURAL ENGINEER REQUIRED by a British Firm in India, capable of organising and controlling office staff, including designing, estimating, drawing and correspondence. Good salary and prospects for really suitable engineer.—Address, giving full particulars, P3901, The Engineer Office, P3901 A

TECHNICAL REPRESENTATIVE with Commercial experience REQUIRED, having intimate knowledge of modern British and American Machine Tools.—Apply by letter only, stating experience, age, and salary required, to CHARLES CHURCHILL and CO., Ltd., Albion-street, Gaythorn, Manchester. 7011 A

THE STANTON IRONWORKS COMPANY, Limited, near Nottingham, REQUIRE the SERVICES of an experienced RATE FIXER for Pattern, Moulding, and Machine Shop Departments. Experienced in the Rowan system preferred.—Apply in writing, giving age and full particulars of experience, to the FOUNDRY GENERAL MANAGER. 6967 A

WORKS MANAGER.—An Opportunity Occurs with a well-known British Firm for a WORKS MANAGER, age 35 to 45 years, with a record of successful experience in the design and economical production of Steam, Gas and Oil Power Plants and Compressors. This opening offers excellent scope for the right man. Give details, including age, training, experience, and salary required.—Address, 7035, The Engineer Office. 7035 A

For continuation of Small Advertisements see page 3.

A Seven-Day Journal

French Navy Estimates.

The French Navy Estimates for 1928, which now await parliamentary sanction, provide for a total outlay of £20,400,000. This substantial increase on expenditure in the current year is accounted for mainly by the large number of new vessels which are coming into service as the long-term building programme matures. The programme itself is behind time, and credits for the present year's quota of construction have not yet been voted. In 1927–28 there are to be laid down one 10,000-ton cruiser, six flotilla leaders, six submarines, and two despatch vessels, and the building plan for the coming financial year will probably be of the same character. During the past six years French naval policy, as regards construction, has been unusually consistent and inflexible. Such changes as have been made in the programme refer only to matters of detail. For example, the total number of destroyers has been slightly reduced, but, on the other hand, the tonnage of the flotilla leaders has been increased. Homogeneity is now the guiding principle, in contrast to the former policy of giving almost every new vessel an individual design. The largest ship to be completed in the present year is the aircraft-carrier Béarn, of 21,450 tons and 21·5 knots. She was laid down originally as a battleship. The Duquesne, the first cruiser of the 10,000-ton type, is due for completion this year; the Tourville, a sister ship, is completing afloat; a third unit is on the stocks; and two more are projected. Of the fifty-five sea-going submarines included in the post-war programme, only thirty-six appear to have been begun up to now. A start has been made on the first submarine cruiser, which is to displace 3000 tons, and will, it is stated, generally resemble the British X 1. All the evidence indicates that France has definitely abandoned the construction of capital ships.

High Pressure Gas Research.

Important developments are taking place in the facilities for high-pressure gas research work in Professor W. A. Bone's department at the Imperial College of Science and Technology. Since 1920 the heavy expenses entailed in the work have been defrayed out of grants made by the Royal Society and the Department of Scientific and Industrial Research. Additional assistance has now been promised by the last-named department, and a gift of £3000, together with the promise of an annual subsidy, has been received from Imperial Chemical Industries, Ltd. With these increased resources two new high-pressure gas research laboratories are now being equipped. In one there will be accommodation for high-pressure explosion bomb installations and two pressure-catalytic tube units. In the other there will be means and apparatus for preparing, storing and compressing gases, for the determination of compressibilities, for the calibration of standard gauges, and so forth. Outside the building there will be a 3000ft. and other smaller gasholders, and an experimental gas generating plant. When complete the equipment will include two gas compressors, one working up to 200 and the other up to 1000 atmospheres pressure, a wide range of explosion bombs, capable of withstanding explosion pressures ranging from 100 up to 20,000 atmospheres, and catalytic-tube units capable of withstanding pressures up to 500 atmospheres at 500 deg. Cent. It is expected that most of the equipment will have been installed ready for operation by the end of March next year. A limited number of selected post-graduate research students will then be enabled to undergo a course of training, extending over two years or so, in high-pressure gas research methods. The work will be carried on under the personal supervision of Professor Bone, assisted by Dr. Newitt, Dr. Townend and Mr. Stockings.

Lloyd's Register Scholarships.

For about the past thirty years the General Committee of Lloyd's Register of Shipping has awarded scholarships in naval architecture at Glasgow, Durham and Liverpool universities. These scholarships are valued at £100 per annum, and extend for four years at Glasgow and three at Durham and Liverpool. One scholarship is awarded each year at each university, so that the total annual expenditure is £1000. It is now announced that the Committee has decided to discontinue the award of the scholarships. It is stated that a decreased number of students is taking up the profession of naval architecture and that many who would otherwise take up the profession are turning their attention to other professions which they believe will bring them better remuneration, and at an earlier age. Sometimes, it is stated, the number of candidates at one or other of the three universities has been so small that Lloyd's examinations have only served to determine the order of priority among the students, without being real tests of ability. Moreover, scholarships are also offered by the Institution of Naval Architects, and by private shipbuilding and marine engineering firms. At Glasgow University there are about eighteen such scholarships open to naval architecture students and they range in value from £100 to £150 per annum. One student is not allowed to hold more than one scholarship, although he may enter the examinations for them all. In many cases the same candidate is successful in more than one examination, and has to choose which scholarship he will hold. Naturally, he generally chooses that which is the largest, and as a consequence Lloyd's scholarships are neglected in preference for the others. Within recent years the number of students who sit for and finally accept Lloyd's scholarships has been so small that the General Committee has decided not to award any more. This decision will not affect those students whose tenure of scholarships has not yet expired.

Proposed Harbour Improvements at Boulogne

In news received from Paris some preliminary particulars are given concerning plans for the improvement of Boulogne Harbour, which have been prepared by Monsieur Outrey and are now being considered by Monsieur Tardieu, Minister of Public Works. It is proposed to construct a new breakwater 2 kiloms. in length from a point of the cliffs about 2 kiloms. north of the harbour. With the lengthening of the present Carnot breakwater by 725 m., a completely enclosed outer harbour would be formed. To form new docks a strip of flat land beneath the cliffs would be reclaimed and a new maritime railway station with quays for liners and cross-Channel and cargo boats constructed. It will be necessary to dredge the harbour, and a new branch of the Nord Railway line would be linked up to the existing line by a tunnel. If the proposed scheme is carried out the port of Boulogne will rank in importance with that of Le Havre for Transatlantic liner services, while it is estimated that the new railway arrangements would speed up the London-Paris cross-Channel service by some twenty minutes. The harbour would be well protected in stormy weather and the large space of calm water would, it is claimed, form an excellent base for seaplanes, which would prove invaluable in the event of a cross-Channel seaplane service being established.

A New Generating Station at Battersea.

The proposal to erect a new generating station at Battersea has now been approved by the Electricity Commissioners, and the preliminary designs which were submitted to them are being subjected to careful revision. It is hoped that early in the coming year the construction of the station will be commenced. The site, which is 15 acres in extent, has a frontage on the Surrey side of the river immediately below the Victoria Bridge of the Southern Railway of about 800ft. When the reorganisation which is now in progress is complete current will be generated by the London Power Company in six generating stations at Battersea, Deptford—where there are to be two stations—Bow, Grove-road, and Willesden. The Willesden station is being modernised and extended, and, subject to the necessary consents being received, it will have a capacity of 100,000 kW. Further extensions at Grove-road are only possible to a very limited extent, whilst the Bow station is practically complete. With its transmission lines the Battersea station, which will be the largest of the six, will cost at least £5,000,000, and it will eventually have a capacity of 360,000 kW.

Improving the Port of Antwerp.

On May 9th the Belgian Government granted to the City of Antwerp the rights to an area of about 7500 acres for the purpose of constructing new wharves, docks, roads and railways, designed to improve the port and relieve the existing state of congestion. In addition to these works, it is intended to undertake a large inland waterway scheme, which will include a canal navigable from Antwerp to Liége by vessels up to 1300 tons. Last Saturday the inception of the scheme was celebrated at Antwerp by a function in which King Albert, the Prime Minister, Monsieur Jaspar, and others took part. King Albert, in the course of an address, stated that the new works would make Antwerp the chief port on the Continent, a position which the city held twenty-five years ago before it was outstripped by several of its competitors. Safety of navigation, he stated, would be promoted by the adoption of improvements that would meet the requirements of ships of ever-increasing size.

The Late Mr. Frank Workman.

The death of Mr. Frank Workman, which took place at his home, The Moat, Strandtown, Belfast, on Monday afternoon, November 14th, deprives Belfast of a prominent citizen and a notable shipbuilder. At the time of his death, which occurred after a long illness, Mr. Workman was in his seventy-second year. He was the youngest son of the late Mr. Robert Workman, of Ceara, Belfast, who belonged to a family which was connected with the shipowning family bearing the same name in Glasgow. After completing his education, Mr. Workman was apprenticed in 1873 to Harland and Wolff, and was employed with that firm for seven years. In 1880 he founded the shipbuilding firm of Workman, Clark and Co., Ltd., and was joined in partnership by Mr. George Clark (now Sir George S. Clark), while at a later date Mr. C. E. Allan also joined the firm. From modest beginnings the new firm rapidly rose to be one of the principal shipbuilding concerns of Great Britain. It possessed two well-equipped shipyards, and many fine ships were launched from its slipways. On more than one occasion the tonnage output of Workman, Clark and Co., Ltd., was the largest among British firms, and for many years the name of the firm was always near to the head of the list as regards output. Mr. Frank Workman devoted himself with characteristic energy to the building up of his firm's business, and for that reason he did not enter public life until comparatively late in his career. When the business was reorganised, in 1920–21, he retired from the firm. However, he placed his great personal qualities and eminent business capacity ungrudgingly at the service of the city of Belfast and of Ulster. He was elected the Chairman of the City Corporation's Gas Committee and he filled the offices of High Sheriff of Belfast in 1913, four years later becoming the High Sheriff of County Down. Mr. Workman was also a Deputy Lieutenant for the City of Belfast. He became a member of the Institution of Naval Architects in 1886.

The Shipbuilding Employers' Federation.

At the annual general meeting of the Central Board of the Shipbuilding Employers' Federation, which was held in Edinburgh on Thursday of last week, November 10th, Mr. John T. Batey, of Hawthorn, Leslie and Co., Ltd., was elected President for the ensuing year. Mr. Batey succeeds Mr. John Barr, of Vickers Ltd., who has been President for three years, and during this period Mr. Batey was the senior Vice-President. Those years were notable for the joint inquiry of the Federation and the shipyard trade unions into the conditions of the industry, the arranging of conciliation machinery with practically all the shipyard unions, and finally the effort to persuade the unions to join in a common endeavour to find a suitable index whereby wages might automatically be fixed. Mr. A. J. Campbell, of William Beardmore and Co., Ltd.; Mr. J. H. Edwards, of the Middle Docks Engineering Company, Ltd.; and Mr. A. L. Ayre, of the Burntisland Shipbuilding Company, Ltd., were elected Vice-Presidents; whilst Mr. W. A. Henderson, of D. and W. Henderson, Ltd., and Mr. G. W. Barr, of Vickers Ltd., were appointed Chairman and Vice-Chairman of the Conference and Works Board of the Federation. On the evening of Thursday the retiring President, Mr. John Barr, was entertained to dinner by the Federation. Many speakers paid tribute to Mr. Barr's personal qualities and the value of the work which he has done, not alone for the Federation, but for the shipbuilding industry as a whole. As an indication of the esteem in which Mr. Barr is held by all who are connected with shipbuilding, and as a tribute to the work which he has done for the industry, Mr. Barr was presented during the evening with a piece of silver plate.

A Large Oil Engine Generator Set.

On Thursday, November 17th, there was put into operation at the Shorts-gardens power station of the Charing Cross Electricity Supply Company, Ltd., a 1200-kW oil engine-driven generator set, which is the largest of its type yet constructed in Great Britain. The engine was started by Mr. W. F. Fladgate, M.V.O., the chairman of the Supply Company, and the General Electric Company, Ltd., the main contractors, was represented by its chairman, Sir Hugo Hirst, who was supported by members of the engineering staff of the Fraser and Chalmers Engineering Works, Erith, where the engine was built. The new engine is a six-cylinder unit with 21¼in. diameter cylinders and a stroke of 22in., and it has a designed output of 1760 B.H.P. when running at 300 r.p.m. The generator is a 1200-kW, 180 to 220-volt, shunt-wound machine, specially designed for oil engine work, and it, together with the switchboard, was supplied by the Witton Works of the General Electric Company, Ltd. The set is designed to work, when required, at a 10 per cent. overload, and the full-load fuel consumption is 0·39 lb. per B.H.P. per hour, or 0·56 lb. per kW per hour, with a lubricating oil consumption of 0·005 lb. per B.H.P. hour. There are many interesting features in the design of the engine, such as aluminium pistons, steel liners and steel cylinder heads, to which we hope to return in a later article. The designers are to be congratulated on a plant which, placed on the existing foundations of one of the older oil engines installed in the station, develops exactly three times the output of the old engines. With fuel oil at £4 per ton and a load factor of 70 per cent. it is expected to generate current at under one halfpenny per unit, including the cost of both fuel and lubricating oil, together with wages and repairs and maintenance charges.

An American Diary.

No. XVII.*

THE MERCURY BOILER.

"Sir," quoth he to the priest, "let your man goon
For quyksilver, that we it have anon.
And let him bringen ounces two or three;
And when he cometh, as faste shul ye see
A wonder thing, which ye saw never ere this."

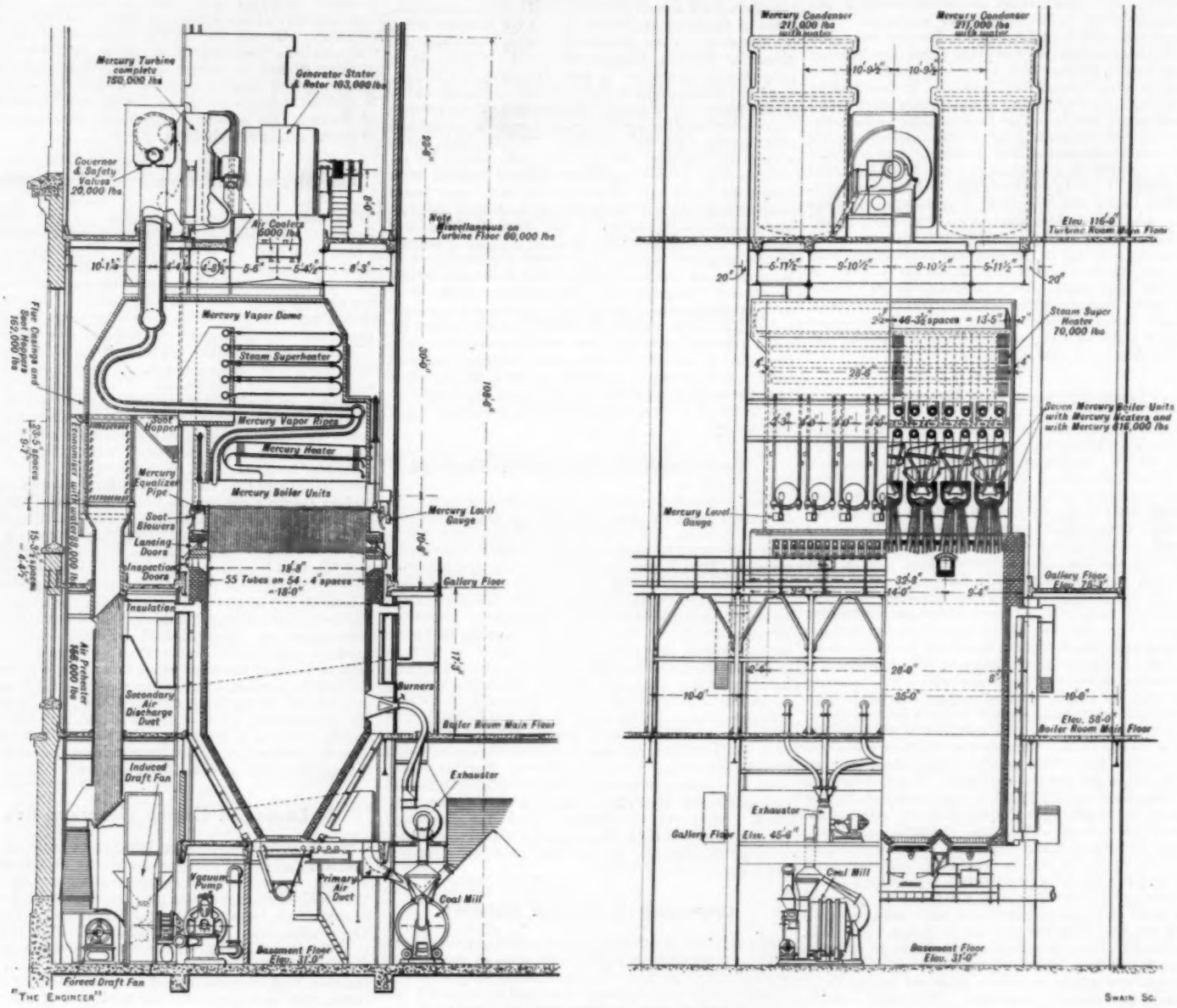
WE are not to tell, to-day, of a rogue of a canon gulling a priest with hank-panky tricks, but of genuine alchymysts transmuting mercury, not indeed into gold, but into power, which is more than gold. The mercury boiler and turbine plant which Mr. Emmet, of the General Electric Company, invented a few years ago is making such progress in America that we have actually heard the makers of normal boilers and furnaces express some concern lest it should cut into their trade! Yet it is little more than four years since the little plant at Hartford was started up. We cannot think that, as yet, there is any real cause for anxiety, for although the original 1200-kW plant at Dutch Point has, by all accounts, given no serious trouble and has realised a higher efficiency than any single-fluid plant, there is much still to be learnt, both concerning the theory and the practice of this binary-fluid arrangement. A much bigger plant is now under construction by the General Electric Company for the South Meadow Station at Hartford. It is to develop 10,000 kW in a mercury turbine and 10,000 kW in a turbine which is to be supplied with 12,500 lb. of steam per hour by the mercury condensers. We give a drawing of the new plant, but we doubt if it should be read too literally. We fancy that experiments are still toward, even whilst the parts are being made, and we shall not be surprised if the actual plant when completed shows a few variations from the drawing.

The boiler is, of course, the object of greatest interest. It will be recalled—those who wish to refresh their memories may turn up THE ENGINEER of November 23rd, 1923, and January 18th, 1924—that the old plant has a circular, drum-type, boiler, in which the tubes form a sort of honeycomb. Not an easy boiler to make. It was fired with oil. The new boiler is quite different. The essential part is a horizontal drum, from the lower part of which extend downwards, like quills upon the fretful porcupine, a large number of Field tubes of special design. We give a section through one form of drum; in it the tubes can be seen, but it will be difficult to follow certain details owing to the closeness of some of the lines. The arrangement consists of an external tube open at the top, where it enters the drum, but closed at the bottom. Within this tube fits, with a small annular clearance, a second tube, also open at the top and nearly closed at the lower end. Inside this inner tube there is yet another of much smaller diameter which passes through a plug in the top of the second tube and is welded to the hole in the bottom of that tube. It is open at the top. The reason of this nest of tubes may be easily guessed. It is, for obvious reasons, desirable to keep down the quantity of mercury to the minimum, but at the same time a large heating surface must be provided. The annulus gives the sought-for effect. The mercury descends by the centre tube and ascends by the annulus, picking up heat. With the same object of economising mercury, the mercury space is partly occupied in the drum by a large block of metal, as seen in the section. This design is dated April, 1927. A reproduction of a photograph taken in February, 1927, shows another way of reducing the mercury space—by an inner excentric drum. A side view of this unit is shown in another illustration. It will be wondered why the drum is so thick when only a moderate pressure has to be withstood, probably 70 lb. or so. We have to guess here, for we do not know. Our guess is that it is to facilitate the fitting of the tubes. It was easier to make a plain cylindrical forged and machined steel drum than to make—and machine—one thickened locally. We saw other units with drums of a different shape—in section like a very much truncated wedge with the broad bottom curved to accommodate the tubes. Perhaps even it is not the final form.

Now let us return to the drawing of the 10,000-kW. boiler. It will be seen that there are seven of these boiler units arranged in a row over a very big combustion chamber, and it will be noticed furthermore that the boiler is to be fired by two unit pulverising mills, supplying fuel to horizontal burners. The course of the mercury vapour may be followed without much difficulty. It ascends to a turbine, which is a three-stage impulse machine, placed between two condensers. The rotor of the turbine is overhung so that there is no bearing, through which vapour might leak, on the pressure side. The bearing on the other side is, of course, under little more than atmospheric pressure. In the condensers the mercury vapour gives up its heat to water and, converted back to the metal, falls under its own head to the boiler.

The course of the hot gases is just that prescribed for any sound boiler design. They pass first over a mercury feed heater, then through a steam superheater, then through an economiser—for water—and finally through a plate type air preheater, emerging at the bottom through an induced draught fan. A forced draught fan drives secondary air upwards through the preheater, and thence into the hollow walls of the furnace, through openings in which it enters upon its duties.

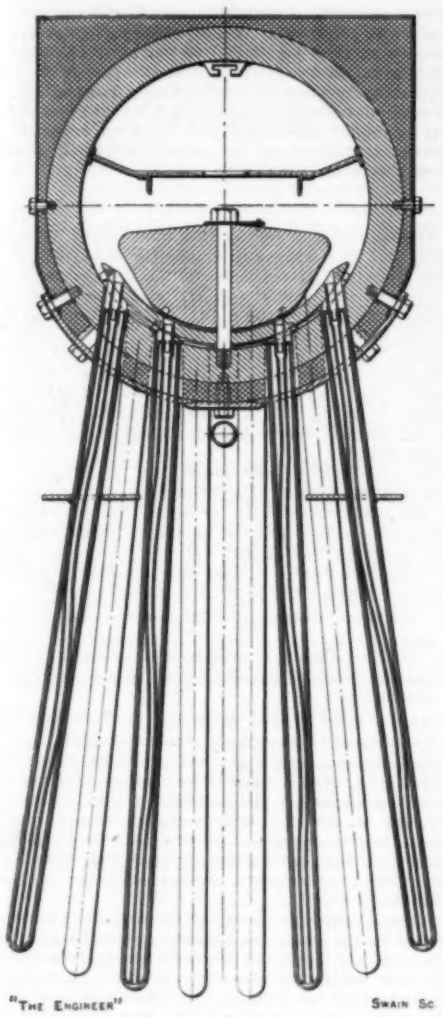
The visitor to Dutch Point asks many questions



10,000 K.W. MERCURY TURBINE PLANT

* No. XVI. appeared November 11th.

about the operation of the plant. He is exceptional if he hears that there have been any serious difficulties. The question of leakage, of course, comes first. Very careful provision against leakage is, of course, made, and as far as possible ventilators are taken to the chimney, so that if a leak should occur it would enter the shaft, where the vapour would return to the liquid form before it could emerge. Another question that arises is the effect of the quicksilver upon the metal of the boiler. It has none, but the boiler tubes, owing to the high temperature, over 880 deg. Fah., have to be calorised externally with aluminium.



SECTION THROUGH MERCURY BOILER UNIT

Mr. Emmet has given the following little table to show the economies which may be effected by the use of his binary-fluid system in different cases.

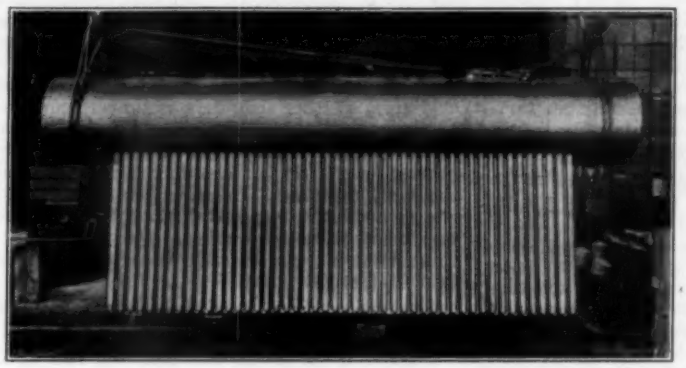
	Steam plant.	B.Th.U. per kWh.		Gain. Per cent.
		Steam alone.	Steam with mercury	
A	Modern 350 lb. station ..	14,000	9,400	50
B	Not quite modern 200 lb. station	17,000	10,400	64
C	Less efficient, small, station	22,000	11,600	90
D	Non-condensing station ..	35,000	13,800	150

In all these examples the assumption is made that the mercury unit is added to the existing units, the steam from the mercury condensers being turned into the normal mains.

Mr. Emmet has also given another table, which shows the conditions which are expected to obtain in the new 10,000-kW plant at South Meadows:—

Output of mercury turbine	10,000 kW
Speed of mercury turbine	720 r.p.m.
Steam produced per hour	125,000 lb.
Steam pressure	350 lb. gauge
Steam temperature	700 deg. Fah.
Mercury vaporised per hour	1,150,000 lb.
Temperature mercury vapour	884 deg. Fah.
Pressure vapour at mercury turbine ..	70 lb. gauge
Vacuum in mercury condenser	28in.
Temperature mercury exhaust	458 deg. Fah.
Gas temperature—	
Beyond mercury liquid heater	950 deg. Fah.
Beyond steam superheater	650 deg. Fah.
Beyond water economiser	480 deg. Fah.
To stack	280 deg. Fah.
Air temperature entering furnace	390 deg. Fah.
Coal burned per hour	14,500 lb.
Heat in coal per pound	14,500 B.Th.U.

Even in America, that progressive and daring land, the attitude of engineers with regard to this system is one of strict caution, and it is probable that the experience of the new Hartford plant will be awaited before further developments take place. There is no reason to doubt that it will be successful, but in mechanical engineering there is always, even in the best-laid plans, an element of uncertainty. On the one hand, troubles that cannot be foreseen declare themselves, and, on the other, unsuspected means of effecting improvements present themselves. It is wise therefore to move slowly. Furthermore, the general adoption of the mercury boiler would have economic effects of considerable importance. The world output of mercury is still small, and that it can be extended materially is uncertain. An increased demand for the metal would send the price up and up. For this reason, and also with the object of reducing danger, alternatives for mercury are being sought, and it may be that before long something suitable will will be found for the use of it.



MERCURY BOILER UNIT

Conclusion.

We are back in New York again. Our long tour is at an end. There only remain a meeting and banquet of the American Iron and Steel Institute, and a few glorious days at White Sulphur Springs with the American Society of Mechanical Engineers. Of the latter we have already spoken in the first few pages of this Diary, yet we wish to make acknowledgments here of the courtesy and kindness—the real friendliness—with which we were received by all the members from the President, "Charlie" Schwab—does anyone call him "Mr." Schwab in America?—through every grade of the Society. Of the permanent officers, Mr. Calvin Rice, the Secretary, and Mr. Davies, the Editor, and many others, we shall only say that both in Virginia and in New York they were tireless in their desire to oblige us. To them and to all that received us, some of whose names have been mentioned, and made us welcome in their midst, refused us no information, and threw their knowledge at our feet, we desire in these closing passages to offer our thanks. They convinced us that there are no kinder, more hospitable people in the world than American engineers, and they made us feel that on their side, as we hope on this, there exists a real desire for a cordial understanding between the engineers of the two nations.

We shall be expected perhaps to give in a few words some idea of the general impression which was left upon us by our tour; to write an *envoy*, shall we say, as defined by Armado, "an epilogue or discourse, to make plain Some obscure precedence that hath tofore been sain." We shall be asked, Is American engineering better than British engineering? Are American engineers more capable, more industrious, more inventive, more enterprising, than British engineers? Can we learn much from them to our profit? Can we apply in our little land the practices that prevail in theirs? Do their industrial methods—of which we have heard so much—appeal to the British mind?

To make full answers to all these questions would require an examination of details which would exhaust the patience of the reader, and, let us add, the knowledge of the writer. We wish to set it down here, in large letters, that no man shall learn America in a few weeks. Whatever may be said after so short a visit as ours must be said with diffidence. To dogmatise is to lay oneself open to conviction of error. No statement, or barely any statement, could be made which was not open to proof to the contrary. Much as we seemed to see in our long tour, many as were the people whom we met, numerous as were the views, opinions and statements to which we listened, we are fully aware that they represent no more than the merest superficies of American engineering and of the opinions of American engineers. We saw the varnish, the bright exterior. It was not for us, in five weeks, to see, save just here and there, the solid material on which the varnish is laid. We may guess that it is good; we may guess, too, that it is not wholly without flaws, loose knots, cracks and shakes which were hidden from our eyes. A great intellect, in a great time, might pierce to the inward construction with his X-rays, show us the atomic structure and deduce from it the strength and real nature of the material. That is not for us. Now let us to our questions.

As to the first. American engineering is no better than British engineering, and in respect to certain things that we prize, it is not so good. But it is better than it was a score of years ago, both in structures and machines. Where it is really in advance of us is in daring. In America, engineers try things which we should not attempt. Often they fail, but sometimes they succeed. They are less cautious, less hesitant about departures from custom. There is, we know, no such thing as a single reason for any human action, but there is always one outstanding reason. In this case it may be expressed in the one word Opportunity. *We* fear to fail because failure means disaster; *they* dare to succeed because success means so much. Consider. The United States cover an area thirty-three times as great as that of Great Britain, but the population is only three times as great. Hence enormous possibilities of development lie open to that country. If a daring experiment succeeds, the harvest to be reaped from it is colossal. For every thousand pounds which we venture upon the development of a new invention, we may foresee a hundred thousand pounds in return. For every hundred thousand pounds which Americans venture they may see a hundred hundred thousand as a reasonable return. The ratio remains the same, but the result is very different. It is the opportunity for development, the certainty of great gains if success is achieved, which stimulates and justifies their huge expenditure on industrial researches

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and encourages the voyages of discovery into new fields of engineering. Put our limitations upon an American engineer, and, as history has shown, he is no more original, no more enterprising, than a British engineer. Had we a potential market of unlimited extent strictly reserved to us—as they have—then, we say without hesitation, British engineers would do all that American engineers are doing. Turn from works in which a market may be developed, and there is no superiority on the American side. In civil engineering, bridge building, water supply, sanitation, railway construction, and all such permanent works, they have no advantage over us, save such as are given by size. It all comes back to this—that things which are worth while in America, because the prospect of gain or of scale of application is very great, are not worth while in a country with far less internal opportunities and no reserved markets.

When we ask ourselves, Can we learn much from them, the answer must be qualified by the considerations which have just been set before the reader. That we can learn a great deal, just as they can learn from us, goes without saying. When engineers meet and do not learn something from each other, there is something wrong. But if we mean by "learn," can we adopt their methods, then we have a different matter to consider. Many visitors who have returned from the United States have endeavoured to measure that country and their own by the same scale. That is vain. What is suitable for them is not suitable for us. Each of us must cut his cloth to suit his own back. Their works, their power stations, the magnitude of their operations, their expenditure on "research," are too big for us. They would fit us no better than their immense locomotives and wagons. The scale by which Americans are to be measured is their own scale. They appear greater than they are when they are measured by ours; we appear less than we are when we are measured by theirs. That they are more progressive, we admit. We have already submitted what we believe to be the true reason of that progressiveness; they have more to gain by it. But it would not be possible if their finances were on the same scale as those of British engineering firms. There is never any lack of money for new ventures. At one time it was so plentiful that it was squandered on wild-cat schemes. Now it is used more prudently, but still with a lavish hand. The American people expect it of their engineers. They are proud of engineering in a way that our people are not. The idea of it has saturated the public; it is encouraged by propaganda. Money flows into engineering concerns of all kinds because the people believe in engineering. Moreover, it has succeeded, it has "made good." The difficulties which beset the industry in this country have passed it by. It has not to fight for a market; the market is there. The whole country wants engineering products, whether they be bridges, automobiles or "juice." It wants to be mechanised; the idea of the mechanical servant appeals to it. Americans are the most industrious, and the most indolent people on earth. "Let the machine do it; we will feed the machines." That is their "slogan."

The attitude of Labour towards engineering is the result of that feeling. It is proud of being a part of the machine that makes machines. It wants the machines itself. It puts its money into the industry because it believes in it. And it draws out good wages because, on the one hand, it encourages the manufacturing machinery, and, on the other, because it is determined to buy what the machines produce. There are, we believe, no limitations on output, and there is a great deal more individuality amongst workpeople than in this country. They work hard for themselves. They have no *arrière pensée* as to the effect of their activities upon others. Their industrial philosophy is not sophisticated; it begins and ends with "I'll make as much as I can." There is not the splendid self-denial which often stirs the British workman to sacrifice his own advantages for the general good of his fellows. Each fights for himself. Collective bargaining is, we believe, rare. It may be used to settle a rate now and then, but the rate has little significance when one can make his own bargain with his employer. There is more feudalism in American works than could be found in this country, but it is of a very beneficent kind. If the men want to have a say in the management they must "say it with shares." Works councils, and organisations of that kind, are not common; as far as we could see, the managers managed. Strikes in the engineering industry are at present unknown; everyone is doing well, there is little or no hatred of Capital, and no one objects to fifty-three hours a week. What is there left to strike for? Moreover, industrially, America is a nation of foreigners. Greeks, Italians, Slavs, Poles, Lithuanians, Germans, French, Irish and British. It is difficult to bring such a conglomerate to one mind. Some want one thing, some another, and they proclaim their wants in a diversity of tongues. Striking is not easy in the United States, and rarely effective. Indeed, if you believe that Capital is helping you as much as you are helping Capital, if you are not tied to your craft and precluded from entering others; if, moreover, there are plenty of other employers if you don't like the one you have got, striking is a senseless action.

There seemed to us to be amongst American engineers, whether they were workmen, employers or managers, a strong corporate feeling. They are proud of their industry, and convinced of its even greater future. It is the common tie which binds them all together. There is, naturally, rivalry and competition, but greater than it is the desire to see the industry flourish. The ruling motive throughout all classes may be expressed truly in A. H. Clough's words—

> "Let us get on as we can, and do the thing we are fit for;
> Every one for himself, and the common success for us all, and
> Thankful, if not for our own sake, why then for the triumph of others."

And so we bring this Diary to an end. It is a brief record—more notable for what is omitted than for what has been set down—of a few weeks that will never be forgotten; weeks full of interest and pleasure and the happy intercourse with brother engineers and fellowmen.

The Public Works and Transport Congress.

No. I.

THE Public Works, Roads and Transport Congress and Exhibition, which are held every two years, were opened on Monday, the 14th inst., at the Royal Agricultural Hall, and concluded to-day. Following our usual procedure, we propose to treat the Congress separately from the Exhibition, and in what follows we give summaries of the contents of some of the first papers considered at the former. There are too many of them for all to be dealt with at one time, and we must hold over the remainder until later issues.

Before beginning, however, we may explain that the Congress and Exhibition, of which his Majesty the King is Patron, and Mr. Neville Chamberlain, Minister of Health, is President, are held under the joint auspices of a number of separate bodies, and that on its Organising Committee, of which Sir Henry P. Maybury, K.C.M.G., C.B., Director-General of Roads, Ministry of Transport, is Chairman, there are representatives of the Ministry of Health, the County Councils' Association, the Association of County Councils in Scotland, the Association of Municipal Corporations, the Convention of Royal Burghs, the Rural District Councils' Association, the Association of District Committees in Scotland, the Institution of Municipal and County Engineers, the County Surveyors' Society, the Scottish District of Municipal and County Engineers, the Highway Engineers' Association of Scotland, the British Waterworks Association, the Incorporated Municipal Electrical Association, the Institution of Gas Engineers, the Association of Managers of Sewage Disposal Works, the County Land Agents' Association, the Municipal Tramways and Transport Association, and the Institute of Cleansing Superintendents.

A very large number of delegates had come together for the Congress, and at an informal luncheon, which was held before the sessions commenced, Sir Henry Maybury, who presided, said that it bid fair to be the most successful gathering hitherto held, and expressed the belief and hope that it and the Exhibition would result in the foundation of a Chair of Highway Engineering in the University of London—a goal at which he had long been aiming.

On the first day of the Congress there was a conference, under the auspices of the County Land Agents' Association. Only one paper was taken. It was by Mr. F. H. Osmond-Smith, County Land Agent, Glamorgan, and it had for its subject "The Advancement of Agriculture." The paper had been awarded the third prize of a bronze medal and £10 in the open competition arranged by the Congress Committee. It is a long paper, and, as it deals with matters which are not immediately concerned with engineering, we propose only to outline its scope and to give the author's conclusions. The paper is subdivided into seven headings, as follows:—(1) Some practical suggestions for the advancement of agriculture and of working the Ministry of Agriculture and Fisheries Act of 1919, and the Small Holdings and Allotments Acts of 1908–1926; (2) the encouragement of a high standard of cultivation amongst smallholders; (3) Diseases of Animals Acts and the Agricultural Holdings Act of 1923; (4) notes on rural housing, its promotion and development; (5) how local authorities can assist afforestation; (6) the need of promoting and extending agricultural co-operation; and (7) education in relation to agriculture.

Commenting on his paper in conclusion, the author remarked that its subject matter, "Agriculture," had been a bone of contention amongst the several interests connected with it, viz., owners, farmers, smallholders and labourers, for many years. Consequently it had naturally afforded politicians and others ample scope for activity, some of which had been well directed and some otherwise. Unfortunately, however, for the nation, they had failed to recognise its national importance, and until that was done, as it must be ultimately by force or circumstance, the goal which all desired to achieve would not be reached. The best method of arriving at it was by a system of evolution and taking advantage of all existing facilities such as they were and improving them.

The conferences held on the morning of Tuesday, 15th, had been arranged by the Incorporated Municipal Electrical Association and the Institution of Gas Engineers, the general subject being street lighting. There were two papers: (*a*) "Street Lighting Regarded as an Illumination Problem," by Dr. J. W. T. Walsh, A.M.I.E.E., who is senior assistant in the Photometric Division at the National Physical Laboratory; and (*b*) "The Street Lighting of London," by Mr. W. J. Jones, A.M.I.E.E., engineer to the Electric Lamp Manufacturers' Association of Great Britain.

Dr. Walsh's paper—which, by the way, was awarded the second prize of a silver medal and £25 in the open competition arranged by the Congress Committee—dealt with the question of street illumination in its scientific aspect. It might be said at once, he remarked, that the chief requirements of a street lighting system were three in number, viz.:—

(1) The discernment of large objects on the roadway.

(2) The discernment of irregularities in the road surface itself, of its edges, and of any permanent obstructions.

(3) A good general appearance when in operation.

Requirements (1) and (2) must, if possible, be met quite independently of any driving lights on vehicles. Such lights could not fail to be a source of glare, and therefore of danger, to opposing traffic. The only solution of the headlight problem, at any rate in towns, was the provision of street lighting of a standard such that no vehicle lights—other than mere recognition lights—were necessary or, in fact, permissible.

Although agreement on the broad principles represented by the three requirements enumerated above was probably universal, it was doubtful whether there was any subject in the realm of illuminating engineering which was less clearly understood or in which there was more diversity of practice among experts than street lighting. It had often been urged, for instance, that the ideal street lighting system would be one providing uniform illumination of the road surface—requirement (1)—and very low values of the variation range—ratio of maximum to minimum illumination—had been laid down. Then again, in contradiction of the view that uniformity of illumination of the road surface was the aim in street lighting, it had been pointed out that the surfaces of objects on the roadway were usually vertical. Thus it came about that, while for requirement (2) the illumination of the road surface was of the greatest importance, for requirement (1) the illumination of vertical surfaces had to receive at least equal attention. Still another aspect of the problem was the value of the "silhouette" effect in rendering objects visible on the roadway—requirement (2). In many cases such objects appeared dark on a brighter background formed by the road surface behind them, and they were therefore visible, not by reason of the light by which they were illuminated and which they reflected to the eye, but because they were so much darker than the road surface that they were thrown into violent contrast with it and were therefore readily picked out by an observer. That effect was specially noticeable when the road surface was wet or polished, so that distant street lamps were reflected from it as from the surface of a river or a pond. Against the bright streaks thus produced on the roadway objects could be clearly discerned in "silhouette," although they could not be seen by direct illumination.

Another matter on which little or no agreement had so far been reached was the height above the roadway at which illumination measurements should be made, although that materially affected the results obtained in many types of installation.

Criteria of street lighting excellence that had been proposed or actually adopted at various times included (*a*) the minimum illumination of a horizontal surface at the level of the roadway or at a height of 1 m. above that level (3); (*b*) the minimum horizontal illumination, combined with a maximum variation range (ratio of maximum to minimum) (4); (*c*) the minimum illumination of a vertical surface at a given height

above road level (5); (*d*) the minimum illumination of a surface inclined at 45 deg. to the vertical and at a height of 4ft. above the roadway (6); (*e*) the minimum direct illumination, *i.e.*, the illumination of a surface normal to the light rays (7); (*f*) the total light flux reaching the surface of a hemisphere of unit superficial area placed at the point where that flux is a minimum (8); and many other modifications or combinations of those values.

The chief defect of the minimum horizontal illumination as a criterion of street lighting excellence was that it took no cognisance of the average illumination of the street. For that reason the combination quoted in (*b*) above was much superior. The choice of a value for the maximum permissible variation range was, however, one of considerable difficulty, especially if the illumination measured was that of a horizontal surface. In order to reduce the variation range it was clearly necessary to increase the candle-power of the lamps in directions just below the horizontal, say, 15 deg. to 25 deg. downwards. The result was that the dazzling effect on users of the roadway was much increased, for the normal line of sight was close to the horizontal, so that the lamps appeared at their brightest just when they were closest to the direction of view, *i.e.*, when their dazzling effect was greatest.

It was to be noticed, the author continued, that in all the criteria enumerated above no attention whatever had been paid to one of the most vital factors in street lighting, viz., the reduction of visibility due to the glaring effect of the street lamps themselves on the eyes of the observer. The object of his paper was, he said, to show how that effect might be evaluated for any given system of lighting so that absence of glare might be considered with the other factors such as the general level of illumination, which made for good street lighting.

Dr. Walsh then went on to discuss the essentials of good street lighting, and concluded that portion of his paper by remarking that from what had been said in that section it would be clear that the conditions governing the visibility of objects in the roadway might be divided into two categories. There was first the objective side of the problem, the production of a maximum degree of contrast for the eye to perceive, and then the subjective problem, *i.e.*, that of producing a maximum of brightness with a minimum of glare so that the eye was in the best possible condition to perceive the contrasts which were presented to it.

In order to determine for any specified system of street lighting the contrast which a given object would present with its background at various positions along the roadway, it was clearly necessary to make certain assumptions as to the nature of the road surface and of the objects to be perceived. As far as the latter were concerned there could be no question of control over their reflection characteristics. All that could be done in that case was to assume a fair average figure for the reflection factor, *i.e.*, that fraction of the incident light which was not absorbed but was reflected from the surface and scattered in all directions. It was probably not unreasonable to take a figure of 7 per cent. as representing the reflection factor of the ordinary inconspicuously clad pedestrian. As far as the road surface was concerned the matter was one of even greater difficulty. It was not infrequently assumed that that surface was perfectly diffusing, *i.e.*, that any given part of it appeared equally bright whatever might be the direction from which it was viewed. That, however, was seldom, if ever, a fact. It had to be remembered that when street lamps were placed at a distance apart equal to, say, ten times their height, the light reaching that part of the road midway between posts struck the road at an angle of nearly 80 deg. with the vertical. Moreover, the angle of view was always very close to 90 deg. For instance, in the case of a point on the roadway only 80ft. ahead of an observer whose eye was 5ft. above ground, the angle of view was about 86½ deg. from the normal, *i.e.*, 3½ deg. from the horizontal. It was well known that, under conditions such as those, even the most nearly perfect of diffusing surfaces showed very marked departures from the ordinary cosine laws which were assumed to apply to such surfaces under ordinary conditions of use. It was therefore quite unreasonable to apply those laws to any road surface even in dry weather.

The matter was further complicated by the fact that some road surfaces, such as asphalt, were noticeably affected by wear. Rain, too, had a very great influence on the reflection characteristics. A road when wet was generally much darker than when it was dry, but it was a matter of common observation that a wet tarred road was generally very shiny, patches and streaks of considerable brightness making their appearance at intervals owing to direct reflection of the light from distant street lamps. Those bright patches had a distinctly glaring effect which made it all the harder to discern objects against the neighbouring dark portions of the road. The most useful factor in detection under those conditions was the silhouette effect. It was clearly impossible to take account of all the possible conditions under which a given road surface might appear, and all that could be done was to consider it when dry and in its normal working condition. The assumption of perfectly diffuse reflection was not valid and more study should be made of the reflection characteristics of common road surfaces, particularly when the light was incident and the surfaces were viewed at angles of 80 deg. to 88 deg. with the normal.

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Except in the vicinity of a post, an object on the roadway would be more or less uniformly illuminated so long as its height was small compared with the mounting height of the lamps. The background against which such an object was seen was an extended length of the roadway, especially when the object was at some distance from the observer. If, then, it were possible to have the surface of the roadway uniformly bright, it might well happen that the brightness of the object would be approximately the same as that of its background, so that the contrast would be very small and the object would not be discernible unless its surface presented bold contrasts so that they could be distinguished without reference to any background. It would thus be seen that a complete uniformity of brightness of the road surface was not desirable even if it were attainable; a certain variation range was necessary to ensure that, whatever the brightness of the object viewed, it should always present a sufficient contrast with some part or other of its background.

It might be concluded from what had just been said that the best form of street lighting would be that in which bright patches in proximity to the street lamps were separated by stretches of very poorly lighted roadway. Further consideration, however, would show that that is not the case, for the visibility of an object depended on the general brightness of the background as well as on the contrast. The lower the general brightness, the greater the contrast necessary for visibility, and it might well happen that a small object was viewed against only a limited stretch of road. Moreover, when the background itself was patchy, the object consisted of large numbers of alternately bright and dark horizontal strips—as compared with its background—and the visibility of such an object was exceedingly poor. In fact the discernment of a small object on a very uneven background was quite as difficult as the discernment of an object which was itself very uneven in brightness, a difficulty which was the underlying principle of concealment by so-called "dazzle-painting." A large variation range was, moreover, very trying to the driver of a vehicle, for it was a matter of common observation that the efficiency of the eye was lowered if the brightness of the field of view alternated rapidly between widely different values. . . . For all these reasons an evenly graded illumination with a moderate variation range was to be desired. A brightness range of between 4 : 1 and 10 : 1 was probably quite satisfactory, and that, taking into account the special reflection characteristics referred to, could be achieved with a considerably larger variation range of illumination.

After dealing with such matters as "Brightness and Glare," "The Importance of Shading," and the factors introduced by (*a*) a bend in the roadway, (*b*) a departure from the horizontal, and (*c*) the reflection of light from neighbouring buildings, Dr. Walsh concluded by remarking that it was unnecessary to strive after too uniform an illumination of the road surface. A variation range of 40 was generally quite satisfactory, and that would usually lead to a very much smaller variation range of brightness owing to the increased reflection factor of the roadway for light incident at angles approaching 90 deg. Glare was, he added, a dominant factor in street lighting, and it was of the first importance to ensure that any street lighting system was free from all unnecessary glare, *i.e.*, any glare which could be removed without noticeable reduction of the street illumination. By paying due regard to that fact the lighting of the great majority of streets could be materially improved without any additional maintenance cost and with only a trifling cost for shades or similar devices.

Mr. Jones began the first part of his paper by remarking that the problem of street lighting in the London area became daily more important, owing essentially to the rapid changes which were taking place in the habits of the people. In general, the streets were more congested than they were, and the greater speed and volume of traffic imposed greater responsibility on those who had street lighting in hand. Thoroughfares which previously were essentially of a residential character had become, or were fast becoming, centres of business and main traffic arteries leading into the heart of London. On every hand there was a demand for better street lighting, and although in certain areas some improvements had been effected, the general state of affairs was very much like that which was in being in 1914. Undoubtedly the Great War prevented much development, but the condition of affairs at the present time was such as to warrant the earnest consideration of all concerned. The majority of our roads and streets were, for the most part, inadequately lighted from whatever point of view the matter were considered.

It was now over twelve years since a paper on the subject was read before the Illuminating Engineering Society,* but since that time the technique of street lighting had advanced, and many improvements in the design of equipment had been effected. The gas-filled lamp had undoubtedly revolutionised electric street lighting, and the introduction of more efficient gas burners had brought about improved efficiency in gas lighting, while the introduction of more accurate methods of light distribution was doing much to bring about general improvements.

Street lighting appropriations were entirely inadequate to meet present-day requirements. Throughout England the appropriation amounted to only 5·3d. in the pound, or less than one halfpenny in the pound per month. That surely was not realised by the average member of a Lighting Committee and certainly not by the general public. In many instances monies spent on public libraries, baths, &c., exceed that expended for street lighting purposes; while the cost of scavenging the roads and watering them was often 50 per cent. greater than that of lighting. There was probably no other public service which could be met so readily and appreciated by the public for so little cost. The problem of improving the public lighting of London as a whole was an urgent matter.

The author then proceeded to discuss, in turn, "Requirements," "Visibility," "Intrinsic Brilliancies," "Classification of Streets"—in connection with which he made some suggestions on street classification—and "Illumination Values."

The second portion of the paper was devoted to an historical note concerning the street lighting of London, and ended with the proposal to found a London Public Lighting Department. The institution of such a department could not fail to ensure more economic operation of street lighting, and bring about a higher standard of illumination in the streets of the Metropolis. It would directly effect the following:—(1) Make possible a uniform policy in the lighting of streets; (2) provide means for effecting investigations and improvements as a whole; and (3) such a department could fully investigate the design of lighting fittings, test electric and gas lamps, and carry out regular inspection of street illumination.

Mr. Jones, in conclusion, said that he realised that such a paper as he had presented was of little value when confined to criticism, and it was for that reason that he made the following tentative proposals for constituting a street lighting authority for London.

Proposals.

(1) A central organisation under the London County Council to have the oversight of all street lighting problems in the London area. This organisation to be controlled by a street lighting board, representative of the existing lighting authorities.

(2) The organisation to be constituted on somewhat similar lines to that already existing in Glasgow; the administration to be carried out by a senior officer with assistants who would be responsible for various areas or special aspects of public lighting. Each superintendent of lighting for a given area to be in charge of depôts and responsible for street lighting in his area both as regards new work and maintenance. The senior officer to be responsible to the above-mentioned committee for the efficient working of his department. Such a central organisation would require a qualified staff of engineers and equipment for fully investigating the design of lighting fittings, testing electric lamps, mantles, &c.

He was quite aware that the constitution of a London Public Lighting Department would require much fuller consideration than outlined in these proposals, but it appeared to him that the two main proposals were of fundamental importance, and it was hoped that they would afford an opportunity of giving this matter fuller discussion.

In the afternoon there were two conferences, one under the auspices of the Municipal Tramways and Transport Association and the other arranged by the Institution of Gas Engineers. The paper before the first was entitled "Is there any Future for Light Railways in the British Isles," and was by Mr. R. D. Gauld, Assoc. M. Inst. C.E., of the temporary electrification staff of the Southern Railway.

The author commenced by saying that at various times during the last sixty years attempts had been made in this country to stimulate the construction of light railways, but such attempts had only had a very moderate amount of success. Compared with the mileage of light railways in other European countries, and in India the extent of such railways in the British Isles was negligible. . . . A summary of the results of all applications made to the Light Railway Commissioners since 1896 and to the Ministry of Transport up to the end of 1922, showed that 726 schemes, totalling 5188½ miles, at an estimated cost of £42,532,284, had been considered, but that orders for only 468 lines, representing a length of 1215½ miles and an expenditure of £17,773,890, had been made.

In a final report issued by the Light Railway Commissioners, it was stated that in the agricultural districts the chief cause of the failure to stimulate construction of light railways was the difficulty of operating the constructed lines with a remunerative margin, owing to the relative scarcity of traffic suitable for those railways—a difficulty almost inevitable, having regard to the nature of the country served. Pastoral country, the report continued, had neither the population nor the produce to bring remunerative traffic to the railway, unless it could be augmented by traffic from quarries, factories, forests, &c. For

* Leon Gaster, Illuminating Engineering Society.

heavy crops, such as potatoes, beetroot, and corn, however, direct rail access was essential, and the increasing importance of those crops was now recognised. In remoter districts, where traffic was light, cheap transport was still necessary, but was largely supplied by mechanical vehicles on the roads.

Dealing with light railways laid on roads, the report went on to say that continental practice in that direction had not been much followed in Great Britain, except for light railways of the overhead electric tramway type. Developments of that kind had been fairly considerable, and would have been greater but for the opposition of the existing railway companies which claimed that they would have suffered by the abstraction of local passenger traffic, and usually succeeded in having the procedure under the Light Railways Acts ruled out on those grounds.

In fact, the Commissioners freely admitted that results up till 1921 had been disappointing, but they expressed themselves optimistic about the future. They were careful, however, to emphasise the necessity of having some organisation of local transport, and suggested that isolated, individual efforts to secure the desired object were not so likely to succeed as was a venture that was a part of a carefully planned-out programme for an area.

After reviewing briefly the light railways of Ireland, Belgium, France, Hungary and India, the author proceeded to discuss future possibilities, and made a hopeful reference to the usefulness of light steam rail units, particularly mentioning the Sentinel-Cammell machine. He concluded by saying that one feature of life in the British Isles at present which made him optimistic as to the future of light railways was the steadily increasing demand for transport of all kinds. People were learning to travel, and were liking it. In other words, there was an expanding pool for transport agencies to draw on, a happy state of affairs for prospective new railways.

Bearing in mind the reasons why light railways in these islands had not been particularly successful in the past, and with the knowledge that the Government Department concerned was favourably inclined towards light railway development, that much cheaper methods of operating light railways had recently become available, and that the demand for transport was always on the increase, he considered that we were justified in thinking that there was a future for light railways in the British Isles.

The paper before the Gas Engineers' conference was entitled "The Gas Industry's Contribution to Smoke Abatement," and was by Mr. F. W. Goodenough, the executive chairman of the British Commercial Gas Association. In his opening remarks the author explained that it was not the purpose of his paper to give any account of the nature and incidence of the damage done by coal smoke. It was well known that the cost of smoke to the community was enormous, and he believed it to be a moderate estimate to put at no less than £40,000,000 a year the total loss due to avoidable waste of fuel, damage to property of all kinds, loss of time through transport delays arising from smoke-fouled fogs, and similar evils traceable to smoke. The additional injury to health for which coal smoke was responsible, whether by polluting the air we breathed or by depriving us of sunlight, was positively colossal, but could not be assessed. The facts were, however, too well established to admit of any doubt that a determined effort to reduce the smoke nuisance was the most urgent of all sanitary reforms of which this generation stood in need; while the economic importance of preventing smoke was perhaps sufficiently brought home by quoting the statement of the Coal Commission report that in the coal mining industry "in effect the work of over a million men for three days every year is devoted to providing the soot which pollutes our atmosphere." And that was, of course, only one aspect of the waste which coal smoke represented.

The home consumption of coal in Great Britain was 170 million tons per annum, made up as follows:

	Tons.
Domestic	34
Miners	6
Coal mines	15
Railway—for all purposes	15
Coasting steamers—bunkers	1
Gasworks	17
Electricity works	8
Pig iron manufacture	12
General manufacture and all other purposes	62
Total	170

An outstanding fact brought out by those figures was that 40 million tons—including miners' coal—were consumed in a raw state for domestic purposes, while an additional 62 million tons were needed for general manufacturing purposes, though probably only about 50 of that 62 million tons were actually consumed in a raw state. The domestic consumption was, however, by far the more important item in relation to the coal smoke problem, for, although the raw coal consumption of industry was higher than that of our homes, the accepted estimate was that five times as much soot was emitted by domestic as by industrial chimneys. Domestic smoke was also entitled to claim attention, first, for the further reason that it was immediately possible very substantially to reduce it. It had, indeed, already been enormously reduced, and it was important to be quite clear how the reduction had been brought about. In 1912 the annual soot fall in London stood at about 75,000 tons. By 1925 it had fallen to 35,000 tons—almost a 50 per cent. reduction in only 13 years. We might safely assume that the reduction of domestic smoke had been of a similar order over the whole country during the same period. But the curious fact emerged that, according to all the estimates, the domestic consumption of raw coal during those same years had remained almost stationary, or had dropped, at most, by 2 or 3 per cent. It was worth noticing, in passing, that even a stationary consumption of raw coal was evidence of headway; during the years in question the population had only increased by 3 millions, but had on the average tended to enjoy a higher standard of living. That necessarily meant an increased fuel consumption which had, evidently, been met by other fuels than coal. From the smoke abatement point of view, added Mr. Goodenough, that was a gratifying fact.

But what was the explanation of a stationary coal consumption and a simultaneous reduction of nearly 50 per cent. in smoke?

The answers were several. In the first place, it might be admitted that the smoke reduction was not quite as great as sootfall figures showed. The improvement had taken place at a time which corresponded with a period of better town planning and suburban development. The population had been spread more and more round the outskirts of towns, and there were now, on the average, fewer houses to the urban acre. That would account for a proportionately lower sootfall on any given acre, or at any particular soot gauge, even if the raw coal consumption and domestic smoke emission of the whole country remained the same. But that was probably the least important explanation.

Secondly, some credit for the reduction of smoke was certainly due to the improved designs of solid fuel grates commonly installed in new houses. On the average, domestic coal fires caused rather less smoke than in the past. But neither would that explain away more than a fraction of the paradox.

Thirdly, there was the most important fact that the average ash content of domestic coal had increased since before the war by something like 15 per cent. In other words, the raw coal consumption to-day represented 15 per cent. less fuel than the equal consumption, by weight, of fifteen years ago. The 15 per cent. additional ash neither produced smoke nor gave heat, and should not be taken into account at all when considering how the fuel needs of the community were being supplied. From that standpoint, we really ought to say that the domestic coal consumption had, in fact, fallen by 15 per cent., albeit the public was paying for as many tons as ever. Presently it would appear that those fuel needs which coal was no longer supplying were almost entirely being met by gas.

Fourthly, it could readily be shown that the headway made by gas had been to a far greater extent at the expense of coal-fired kitcheners than of domestic coal fires. The coal-consuming kitchen range was notoriously far the worse offender in emitting smoke. Happily, however, it had been so generally replaced by the gas cooker, that it must have ceased already to contribute seriously to the pollution of the air. It was fortunate, from the point of view of cleaning our skies, that the first and most rapid triumph of gas over raw coal as a domestic fuel had had the maximum effect in mitigating the smoke evil.

Such were the explanations of the apparent paradox of a stationary coal consumption and a simultaneous reduction in smoke; and such was the vindication of the claim that the progress of gas had been the chief factor in reducing it.

Mr. Goodenough then went on to show how rapid had been the increase in the rate of consumption of gas, and the directions in which it is now being applied. He also alluded to the competition likely to be experienced from electricity and from solid smokeless fuel; and finally claimed that the general conclusion to which his review of the subject led was that while the gas industry had already materially reduced industrial smoke, there was every prospect of a great and early extension of that process through a far more widespread use of gas. But there were certain industrial fuel requirements which would not be met most generally in that way. Industry required rather more fuel ultimately for the production of heat than for the production of power. But the power load was a large one for all that, and it was likely eventually to be met much more generally than at present by electricity, the output of which was rapidly increasing. But where direct steam power was retained there was no reason why steam-raising should not be rendered smokeless in part by better methods of burning coal, in part by gas boilers which were capable of giving a thermal efficiency of 85 per cent., and in part by the use of coke. Gas coke was at present extensively used for that purpose, with excellent success, as well as in many other classes of industrial plant in which solid fuel was employed, notably in bakers' ovens, laundry boilers and other plant, in which not only its high thermal efficiency but the absence of smoke and soot had an especial value. The ultimate aim for the great majority of industrial purposes must, however, be the elimination of solid fuel altogether. In thermal efficiency solid fuel was always at a disadvantage, and its other inconveniences were many. It had also to be said that for the generation of electricity internal combustion engines run on town's gas could often rival the public supply of electricity from power stations in respect both of reliability and of cost. There were, indeed, many circumstances in which gas engines were the best prime movers for supplying power, but competition with electricity and oil was close, and no generalisations were at present possible or likely to be so in the early future.

Finally, Mr. Goodenough said that he looked upon the prospect of an almost smokeless Britain with real and he believed well-founded optimism. The wastefulness of burning raw coal—no matter for what purpose—was so great that an end to the practice was only a matter of time. In ending it, the chief part was falling to the gas and electric supply industries. The coke oven industry had also its part to play in supplying hard coke for metallurgical processes. Oil had its future, mainly in transport by sea, road and air. It was from the most efficient treatment of coal and the extraction of a maximum thermal and chemical value from it that the greatest contribution to national fuel problems must come. And the most efficient treatment yet discovered was, he claimed, that of high-temperature carbonisation, as practised at the gasworks of to-day.

(To be continued.)

Pig Iron and Power.

Among the various efforts which have been made to utilise the by-products entailed in the conversion of ore and coal into pig iron, those of the Staveley Coal and Iron Company stand out in prominence, as not only do the works, near Chesterfield, maintain themselves without outside resources, but they also provide a supply of electricity to an outside area measuring roughly 16 miles by 22 miles, without the consumption of any fuel beyond that necessary for the smelting of the iron in the furnaces. Incidentally, several of the collieries from which the company draws its supplies of fuel have been fully electrified, and it is noteworthy that these pits make a strong contrast to the average pit where smoke and dirt abound. The concrete structures of these new mines, even after some considerable service, are still of the hue of Portland cement.

Some idea of the extent of the operations of the company may be gauged by the fact that about 54,000,000 units of electricity are produced in a year, while each of the four blast-furnaces which give off the gas necessary for the generation of that amount of power produce from 900 to 1000 tons of pig iron per week. Of the total amount of power generated at the works, from 15 to 20 per cent. is sold outside, and is transmitted at a pressure of 6600 volts to the surrounding townships, where it is transformed down to 440 volts for power purposes and to 220 volts for lighting, both at 30 cycles. The colliery supplies are at 6600 volts, and a connection with the Notts. and Derby Company is, however, transmitted at 22,000 volts, 50 cycles, and transformed down locally to the required voltage. Most of the transmission outside the works is effected by means of overhead wires, and there are some 80 miles of high-tension line covering Staveley, Brimmington, Clown, Eckington, Shirebrook, Barlborough, and Bolsover. There is also an interconnection with the Glapwell plant of the Sheepbridge Iron and Steel Company, besides an arrangement to supply the Notts. and Derby Company with any surplus power up to 4000 kVA at Grassmoor and Dronfield.

In order to obtain the power necessary to supply this large demand it has, of course, been necessary to conserve, to the utmost, the thermic value of the gas given off by the blast-furnaces, as the Cowper stoves have a prior claim to any power production scheme. To this end the plant, of which we give some illustrations on page 570, has quite recently been installed at the Devonshire works of the Staveley Company. The basis idea is to provide as pure a supply of gas as can be, and then to utilise it in the most economic manner possible. In broad terms the whole of the blast-furnace gas is cleared of its dust content, so much as is necessary is supplied to the Cowper stoves for preheating the furnace blast, the requirements of the boilers supplying steam to the blowing engines are satisfied and the balance of the gas is used for power generation.

There is, however, a complication in the system, as the coke required by the furnaces is produced within the works and in the process a surplus of gas is produced. This gas is most thoroughly treated for the recovery of by-products and is then burned under the boilers. It may, nevertheless be quite properly said, that this gas is produced incidentally to the manufacture of pig iron. About 7,000,000 cubic feet of this gas are produced a day, and such of it as is not burned under the boilers is used for general heating in the works and in the Staveley village. It has a calorific value of about 530 B.Th.U. per cubic foot.

The combustible gas coming away from the top of a blast-furnace is, of course, always burdened with a large amount of dust, but in this direction the Staveley furnaces are assisted by the fact that the ore commonly smelted contains from 16 to 20 per cent. of moisture, so that there is a blanket of moist ore in the top of the furnace, which tends to filter out the dust from the gas before it goes into the mains. The gas, after passing through the usual dry dust catchers alongside the furnaces, is collected by a large main running along the back of the furnaces. At the centre of this main there is a branch which leads to the 10ft. main that shows up so prominently in Fig. 1 and can be followed in the drawing on page 561. This main leads the gas to the three scrubbing towers seen in Figs. 1 and 2, page 570. After the scrubbers and Theisen washers the gas passes through a control valve, which has for its object the prevention of the reduction of the gas pressure at the tops of the furnaces below the danger limit. This limit is generally put at about ½in. water gauge, as if the pressure were to fall below that of the atmosphere there would, of course, be a likelihood of air filtering inward and a liability for explosions to occur. In other words, if the demand for

gas is greater than the supply given by the furnaces this valve closes, more or less, and throttles down the flow so as to maintain the pressure at the furnaces. As a matter of fact, the pressure at the inlet to the scrubbers is generally some 2½in. W.G. The gas at this point contains from 28 to 30 per cent. of CO, 2 to 3½ per cent. of H, and has a calorific value of from 96 to 100 B.Th.U.

The scrubbing towers, through which the gas flows upwards, are 15ft. in diameter by 72ft. high. They are packed with wooden grids and are supplied with 5000 gallons of water a minute by a Worthington-Simpson pump driven by a 300 H.P. A.C. motor. The controllers in this part of the works are of the Allen-West type. The pump is installed in the brick building seen in Fig. 2. The water leaves the scrubbing towers at a temperature of about 100 deg. Fah. and goes to the Dorr thickener seen in Fig. 3, page 570, which is 86ft. in diameter. This apparatus is, of course, a shallow tank with a conical bottom, through which the muddy water flows so slowly that there is time for the suspended matter to settle. Within it there rotate slowly four arms, which help the mud to flow toward the bottom of the cone. This mud is pumped away into an adjacent gully, while the clear water goes on to two concrete regulating tanks. The effect of the thickener is to remove from the water about 20 grains of solids per gallon. The water is sucked from the regulating tanks by another Worthington-Simpson pump driven by a 160 H.P. A.C. motor, and is delivered to the spray cooling pond—see Fig. 3—at a pressure of about 25 lb. per square inch. The reason for the regulating tanks is to ensure against any failure of the plant, as, should the pumps stop, the water level would rise and actuate an automatic alarm to attract the attention of the attendant. By the way, only one man is necessary to look after the whole plant. The water required to make up for evaporation in the cooling pond is added in the regulating tanks and amounts to from 10 to 20 per cent. of the whole. A smaller amount might serve the purpose, but the quantity employed ensures that all the mud is washed through the apparatus. From the cooling pond the water is returned to the scrubbing towers.

The gas leaving the top of the scrubbers contains from 1 to 2·5 grammes of dust per cubic metre, and is led by downcomers to three Theisen centrifugal disintegrators, each driven by a 500 H.P. motor. Two of these cleaners are sufficient to handle the whole volume of the gas, so that there is always one in reserve. The centrifugals discharge into the cyclone dryers, which can be seen on the ground level in front of the scrubbers in Fig. 2. At this point the gas has a pressure of from 5in. to 6in. W.G. and contains about 0·3 gramme of solid matter per cubic metre, while practically every trace of moisture has been eliminated.

As we have already said, the Cowper stoves have the first call on the supply of gas, so a regulating valve is installed on the outlet from the cleaning plant to ensure that they get the necessary quantity regardless of the demands of the rest of the plant. From this point onward the run of the gas main can best be followed with the aid of the drawing. The main is 7ft. in diameter and runs along the front of the stoves with tapered extensions at either end to supply the outside stoves, and is continued transversely across the yard to the boiler-house and power station.

Before leaving the stoves, however, it may be as well to mention the great saving which has been effected by firing them with really clean gas instead of with the partially cleaned gas used heretofore. With the comparatively dirty gas it was necessary to use four stoves for each furnace in blast, as, if it was attempted to force a lesser number to heat the required amount of blast air, the chequer work quickly slagged up. Now, however, the clean gas contains so little solid matter that two stoves can be made to do the duty of four, and they are being rechequered to work at the necessarily higher temperature. The new refractories, which were being set on the occasion of our visit, can be seen in the foreground of Fig. 2. The result of this saving has been practically to double the amount of gas which can be sent forward to the power plant.

Following the run of the gas main, it will be seen that there is a branch which serves two batteries of Babcock boilers that raise steam initially for the service of the blast-furnace blowing engines and, incidentally, for general power production purposes. It is here that the intergramme, which necessitates an engine running absolutely continuously for from seven to eight weeks without being shut down for cleaning or decarbonising.

We now come to the utilisation of the "surplus" gas for the purposes of power generation, and we deliberately call it surplus, as we are not much concerned here with that necessary for steam raising to drive the blowing engines, of which there are five sets, each of about 650 horsepower; although even they are intimately connected with the general power scheme, as will be explained directly.

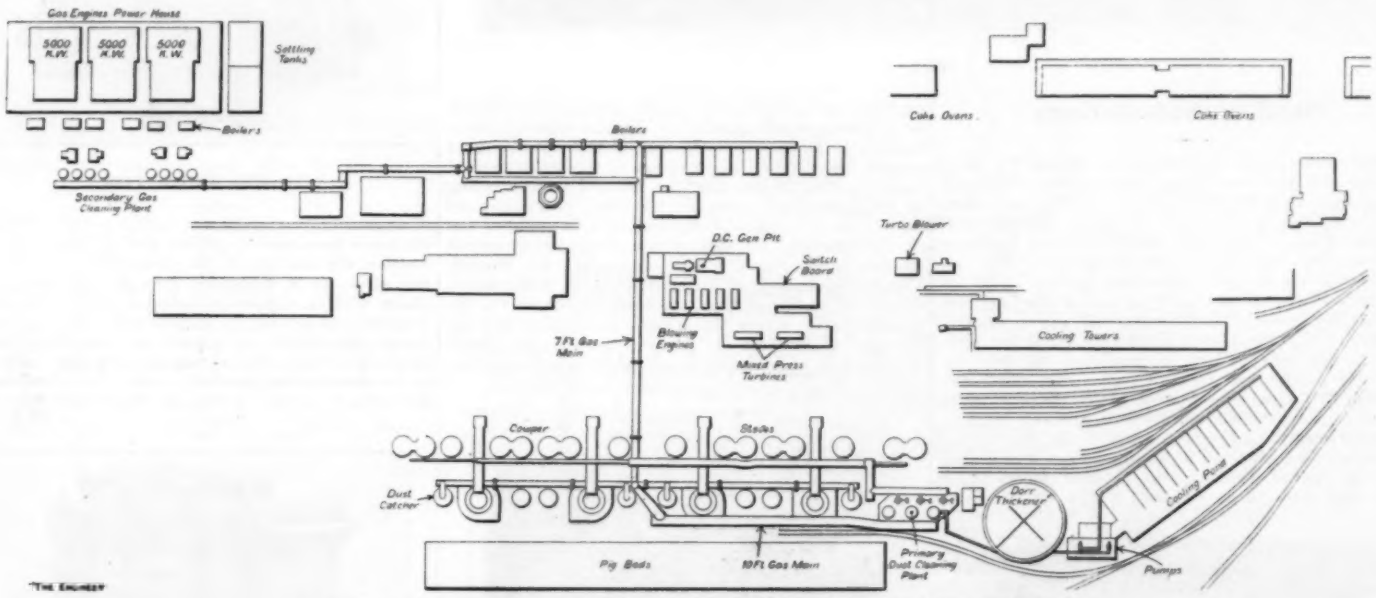
The prime movers at the Devonshire Works comprise three Cockerill gas engines, each driving a 5000 kW alternator, a 5000-kW mixed-pressure Westinghouse turbo-alternator set, another 3000-kW set of the same kind, a 1000-kW low-pressure Westinghouse set, a 1000-kW direct-current reciprocating Browett-Lindley set, and a 500-kW set of the same make. Thus there is a total generating capacity of 25,500 kW, or, rather, there will be almost immediately, when the third of the three big gas engines is put in commission. But even then one is not at an end of the plant supplying the general network, as at the Markham Main pit there is a 1500-kW mixed-pressure B.T.H. turbine, taking exhaust steam from the winding engines, and a 1200-kW A.E.G. set at the Worsop Colliery.

So far so good, but distribution has to be effected as follows:—22,000 volts, 50 cycles; 6600 volts, 30 cycles, transformed down to 440 volts and 220 volts, all three-phase current; and also locally at 240 volts direct current. The interconnection of these various systems is, obviously, a complicated matter, but it is largely facilitated by the installation in the gas engine power-house of two reversible frequency changers, each of 2500 kW capacity, which can turn 50-cycle current into 30-cycle, or *vice versâ*, so that either of the two 6600-volt gas engines can be used to feed the network of either frequency. The net result is that there is, standing by itself, 1500 kW of direct-current plant, while there can be provided, by combination, 19,000 kW of 6600-volt, 30-cycle current, or 10,000 kW of 6600-volt, 50-cycle current, and by means of static transformers (which are just out of sight in the foreground of Fig. 4) 2500 kVA of 22,000-volt current at 50 cycles.

Of the various units comprising this heterogeneous plant it is not necessary to say very much, as they are all of orthodox design, including the large Cockerill gas engines, the first one of which was described in THE ENGINEER of February 6th, 1925, and is illustrated, in its completed form, in Figs. 5 and 6. The latter is noteworthy as being the first at these works to be equipped with exhaust heat boilers, as shown in Fig. 4. There will ultimately be six boilers, two for each engine, and each pair is capable of evaporating some 14,000 lb. of water per hour, generating steam at a pressure of 160 lb. per square inch and 300 deg. Cent. This steam is turned into the general steam pipe range of the works. After service in these boilers the gases are liberated, at last, and it is noteworthy how comparatively silent is the pulsation of the exhaust. The steam for the mixed-pressure turbo-generator is the exhaust from the blast-furnace blowing engines, supplemented, if necessary, by high-pressure steam direct from the boilers.

It will be readily understood that the handling of all this plant to the best advantage is a complicated matter, especially so on account of the distance apart of the steam and gas engine power-houses; but it is surprising what a small amount of switchgear is necessary. Incidentally, the two houses are interconnected by a loud-speaking telephone, and in the telephone boxes there are large-scale diagrams of the network. In the gas engine power-house there is a switchboard on a gallery which can be seen in course of erection in Fig. 5. This board controls the three units in the house and can supply, directly, the long-distance high-tension feeders to Grassmoor and Notts. and Derby; but the principal control is effected in the steam power-house, where there is an equipment of truck-type switchgear. It is here that the gas units are paralleled with the turbo-alterantors and the power is distributed throughout the system. It is the practice to run the gas engines fully loaded and to take up the balance of the load on the turbo-alternators; but if it is unnecessary to run a turbine the blowing engines are allowed to exhaust to atmosphere. Besides the five blowing engines, which are of the vertical type, there is a turbine-driven blower, erected on a platform outside the power-house, but it hardly comes within the scope of this review.

It would, obviously, be possible to go on describing the



PLAN OF THE DEVONSHIRE WORKS OF THE STAVELEY COAL AND IRON COMPANY

S.A. BLAST FURNACE CLOSED DOWN.

On September 24th last it was announced that the Union Steel Corporation had decided to close down indefinitely its blast-furnace at the end of the month. Some twenty Europeans and about two hundred natives are affected. It had been well known for some time that stocks of pig iron were accumulating at an alarming rate. The reason for this was that, although the quality is equal to that which used to be imported, and which it has superseded, the consumption of the Union is quite inadequate to absorb the output of the Newcastle blast-furnace, which has capacity of over 1000 tons per week. The Union Corporation views the future prospects of the iron industry with the utmost confidence, but it is necessary for the various new works at Vereeniging, such as the pipe and tube works which are being erected in conjunction with Messrs. Stewarts and Lloyds, England, to be completed and in operation so that stocks of pig iron can be reduced before operations can be resumed at Newcastle. During the temporary closing down improvements are to be made to the plant so as to be able to maintain the maximum output when the demands increase. There is said to have been a steady decrease in the cost of production, which should eventually secure a profitable export market for any surplus pig iron. This statement, however, is not generally endorsed. There is a widespread feeling that, having regard to existing costs, rail and freight rates, there is no hope of an export trade in pig iron being conducted at a profit. Nor does it appear that the Union's demand for pig iron, even when all the new works which are being erected are in operation, will be equal to consuming an output of about 60,000 tons of pig a year.

110 K.V. 3-PHASE OIL-IMMERSED CIRCUIT BREAKER

ENGLISH ELECTRIC COMPANY, LTD., LONDON, ENGINEERS

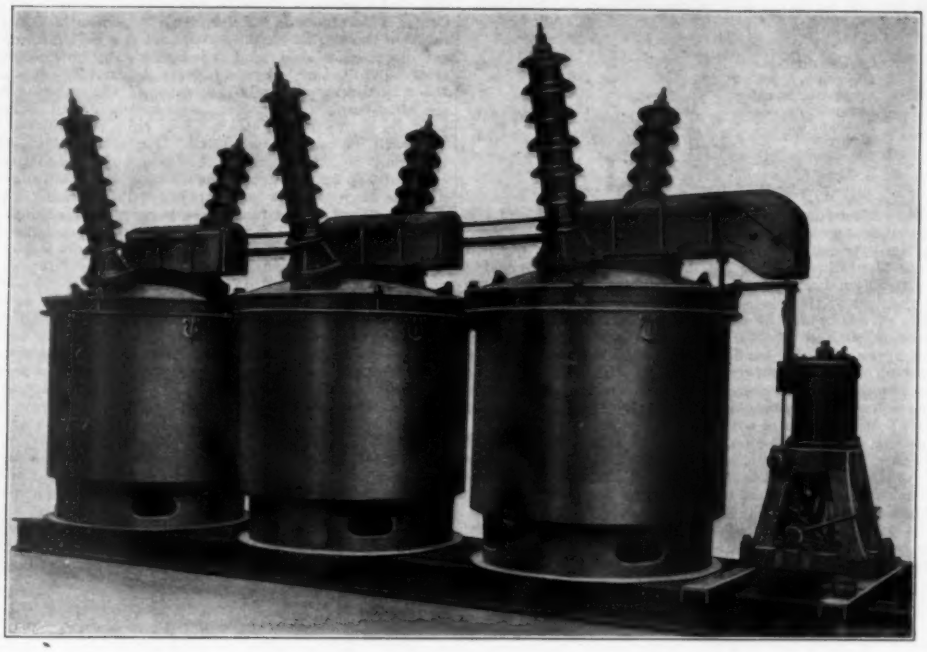


FIG. 1

Outdoor Sub-stations.

THE employment of outdoor switchgear for large sub-stations and switching centres was originally brought about by the adoption of very high pressures, such as 110 kV and 220 kV, which necessitate large clearances and headroom, thereby making buildings unwieldy and expensive. For some time it was not considered worth while installing outdoor gear for pressures of 33,000 volts and below, but the high cost of building material and labour has led to the employment of outdoor equipments for quite low pressures. For sub-stations of medium size and for stepping down the pressure from, say, 6000 and 11,000-volt mains, sheet steel kiosks have recently gained favour in this country where, in many districts, a cheap supply is urgently required. It is a distinct advantage in such cases to be able to run a ring main through several districts and to erect factory-built kiosk sub-stations at suitable points on the ring

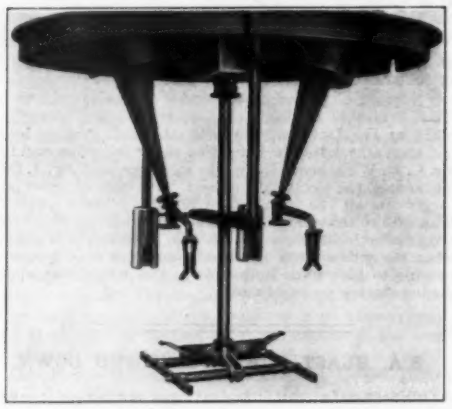


FIG. 2—CIRCUIT BREAKER CONTACT SYSTEM

main. The advantages of this type of sub-station over the conventional type are that there is a marked saving in cost in the space required, and kiosks can be installed in districts where the initial load is expected to grow, as it is a simple matter to replace small transformers by transformers of larger size or to remove complete kiosks to new areas and to put down larger kiosks in their place.

For individual supplies along the route of a transmission line the cheapest possible form of sub-station must be provided, otherwise the cost will prohibit the supply being given at all, and on economic grounds small pole type transformers connected to the line through an oil-immersed circuit breaker, oil-immersed switch fuse, or simply through air break switches and fuses are frequently employed.

The application of portable sub-stations is sometimes advantageous; in brickfields and similar places, for instance, covering a comparatively large area, it is often an advantage to be able to follow up the work with the necessary machinery and plant for reducing the pressure. The switchgear for work of this nature may either be of the outdoor type mounted on a framework on a truck or it may be of the indoor type enclosed in a waterproof kiosk mounted on wheels or a transportable platform. Fundamentally, there is little difference between indoor and outdoor gear design, except for the provision in the latter case of watershed insulators and the general waterproofing of all joints. In practice, however, practically all switchgear for 66,000 volts and over is made of the outdoor pattern. A three-phase oil-immersed circuit breaker unit for 110 kV made by the English Electric Company is shown in Fig. 1, from which it will be gathered that the breakers stand on the ground and access is obtained to the interior through a manhole in the top plate. For lower voltages the breakers are mounted on a framework at

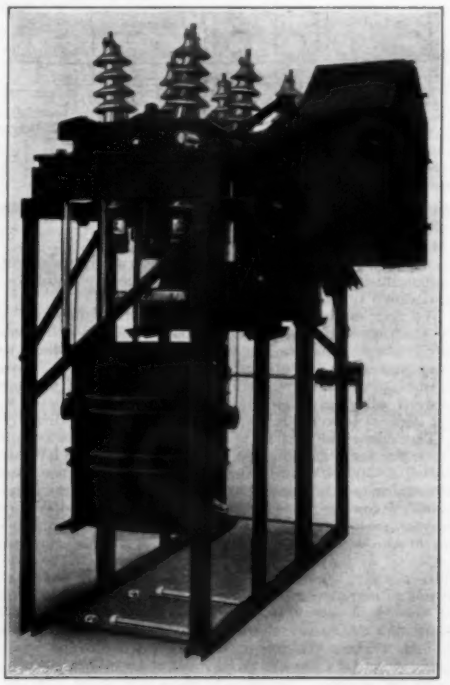


FIG. 3—22 K.V. THREE-PHASE CIRCUIT BREAKER

a sufficient height above the ground to enable the tanks to be lowered, and tank-lowering gear is incorporated in the structure. One of the chief features in the design of the English Electric Company's 66 to 132 kV oil circuit breakers is the arrangement of the contacts at the breaking points. When closed, the main contacts, which are of the laminated brush type, directly bridge the contacts fixed to the bottom of the insulator bushings, but the break takes place on an entirely different set of contacts of the finger type, there being four contacts in series per phase, and a high speed of break is obtained without the disadvantage of a high plunger bar velocity. The contact system is illustrated in Fig. 2, which shows two of the corona shields removed. The contact system embodies a new and patented principle, which, as the result of recent research and investigation, has been found considerably to reduce the stress set up when rupturing the arc. The arcing contacts are designed to break the circuit one after the other, and the timing of the brake is such that one of the four contacts commences to open at the most favourable moment for rupturing the circuit, i.e., when the current is passing through its zero value. Another feature of these breakers is the incorporation of a combination

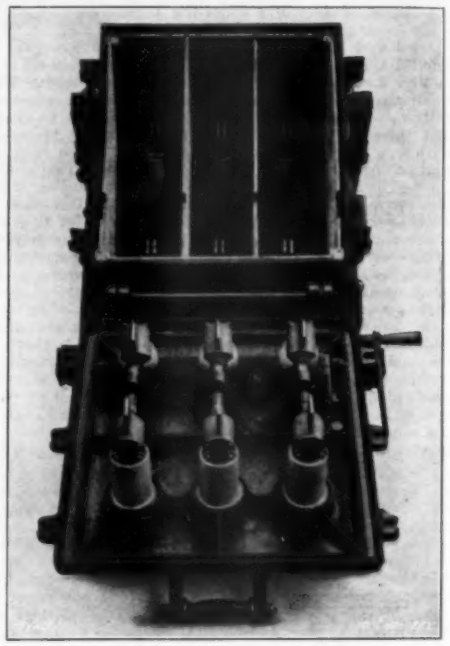


FIG. 4—SWITCH FUSE

of expansion chambers and baffle vents. A limited air space immediately above the oil level acts as a cushion for the shock on opening the circuit, and this air space is connected through perforated metal plates with an expansion chamber which also accommodates the operating mechanism. The perforated metal plates tend to prevent oil throwing, at the same time they allow the pressure in the main tank to be relieved, and they also reduce the temperature and velocity of any oil and gas forced into the expansion chamber. From there any oil thrown up drains back into the main tank, whilst the gas pressure is relieved by vent pipes leading from the expansion chamber, and designed to prevent the ingress of moisture. The condenser type terminal bushings are protected by porcelain rain shields on the outside, and two current transformers of the bushing type per phase can be accommodated on the terminal bushings. The dome-shaped top plate is composed of cast steel and it supports the whole of the terminal

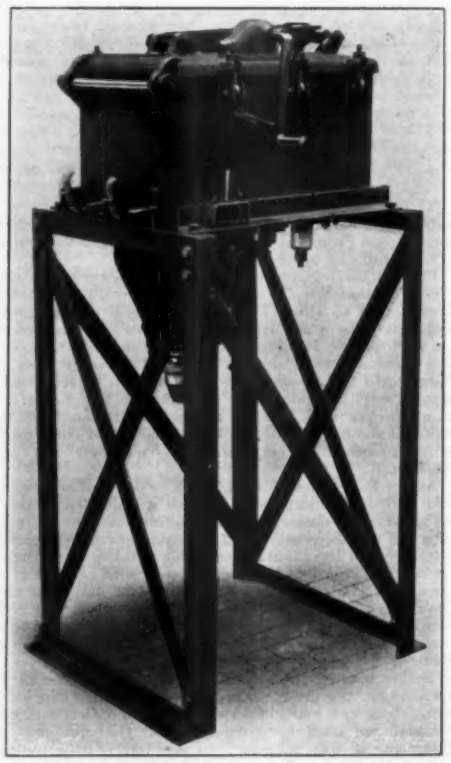


FIG. 5—SWITCH FUSE ON STAND

bushings, contacts, operating mechanism. The circular oil tank is built up of heavy boiler plate. To ensure a layer of quiescent oil around the tank walls under all conditions, the tanks are provided with insulating linings spaced apart from the interior of the tank. The operating mechanism is contained in the enclosure, which forms part of the expansion chamber casing, and removable covers are provided so that the mechanism may easily be inspected or adjusted. The gear is operated by a solenoid or a motor, which may be worked from an alternating or direct-current supply. If no auxiliary supply is available, the motor-operating gear can be worked from a 12-volt portable battery, which can be removed at intervals for charging. A typical three-phase breaker for 22 kV with solenoid-operating mechanism and a weatherproof enclosure and tank-lowering gear, is shown in Fig. 3.

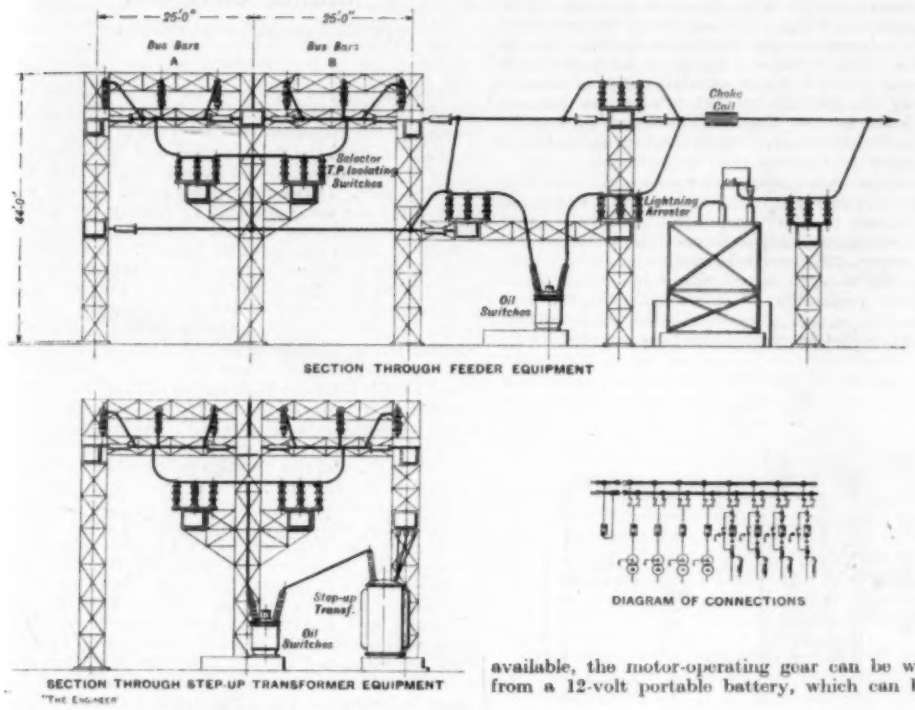


FIG. 6—LAY-OUT OF 110 K.V. OUTDOOR SUB-STATION

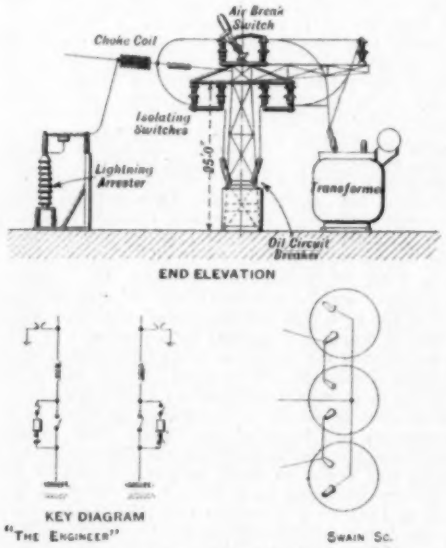


FIG. 7—SIMPLE TYPE OF OUTDOOR SUB-STATION

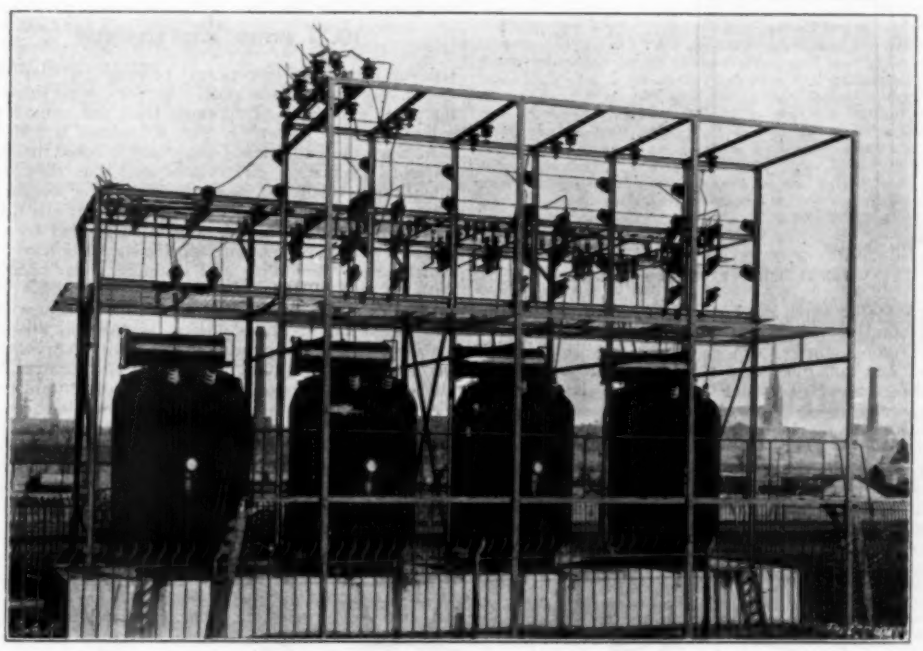


FIG. 9—OUTDOOR SUB-STATION WITH AIR BREAK SWITCHES

Air break switches of the horn type are sometimes employed instead of oil circuit breakers, and occasionally they are made to bridge the breakers which can then be isolated and inspected without interrupting the supply. For 44 kV and over, bushing type current transformers are generally employed, whilst present-day practice at these pressures tends towards the elimination of potential transformers by metering entirely on the low-tension system. Oil-immersed switch fuses are frequently utilised instead of oil circuit breakers in connection with kiosks and small outdoor sub-stations, and the popularity of this class of apparatus is said to be steadily increasing. The English Electric Company has developed an oil-immersed switch fuse which complies with the Home Office regulations and has a definite rupturing capacity. The fuses are held between spring-loaded plungers attached to contacts fixed to insulators supported to the hinged lid, as shown in Fig. 4, and when the lid is closed the contacts engage with fixed contacts in the bottom of the tank, the whole being immersed in oil contained in a substantial cast steel tank. An interlocking device, the handle of which is shown in Fig. 5, ensures that the circuit shall be opened before the lid is opened, and that the lid shall be closed before the circuit is closed. Another attachment specially suitable for outdoor use is an automatic protection cover which, when the lid of the switch is opened automatically, covers the oil tank containing the fixed contacts.

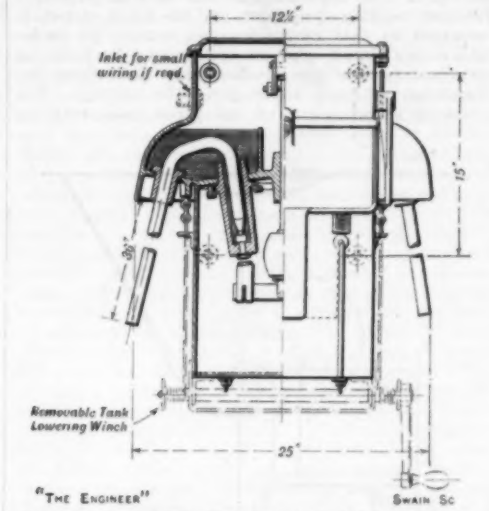


FIG. 10—OIL CIRCUIT BREAKER FOR POLE MOUNTING

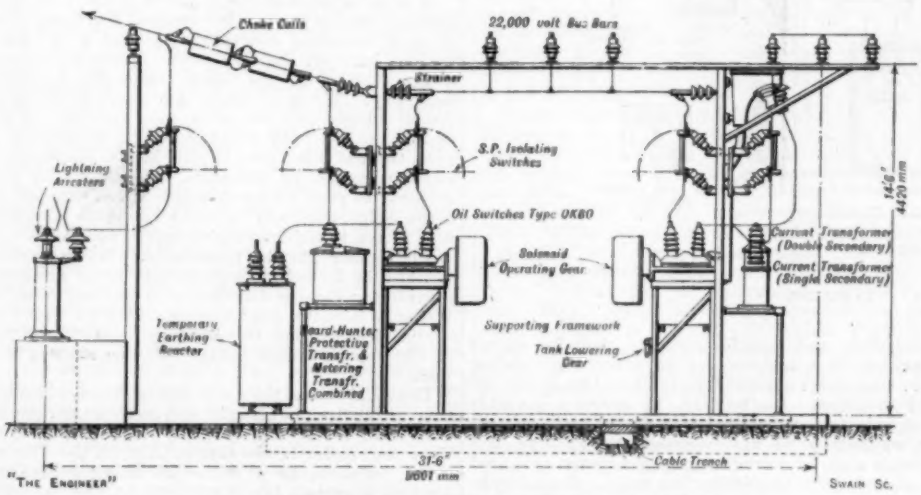


FIG. 8—LAY-OUT OF 22,000 VOLT OUTDOOR SUB-STATION

Test pressures for outdoor gear are usually specified, but failing this the standard flash-over tests applied by the English Electric Company to all insulators are as follows :—

Working voltage.	Dry test volts.	Wet test volts.
6,600	50,000	30,000
11,000	62,000	39,000
22,000	95,000	62,000
33,000	125,000	84,000
44,000	145,000	105,000
66,000	165,000	140,000
110,000	290,000	240,000

The lay-out of a 110 kV outdoor sub-station with

duplicate bus-bars is shown in Fig. 6. This controls four step-up transformer banks, each directly coupled to a 10,000-kW alternator, and also four feeders, each with lightning arrester gear, the oil circuit breakers employed corresponding with those shown in Fig. 1. The duplicate bus-bars have an oil circuit breaker coupling equipment, and the whole station is arranged so that extensions can readily be made. The feeder circuit breakers are bridged by isolating switches, so that the breakers can be isolated for inspection without interrupting the supply. The isolating switches are of the three-phase rotating

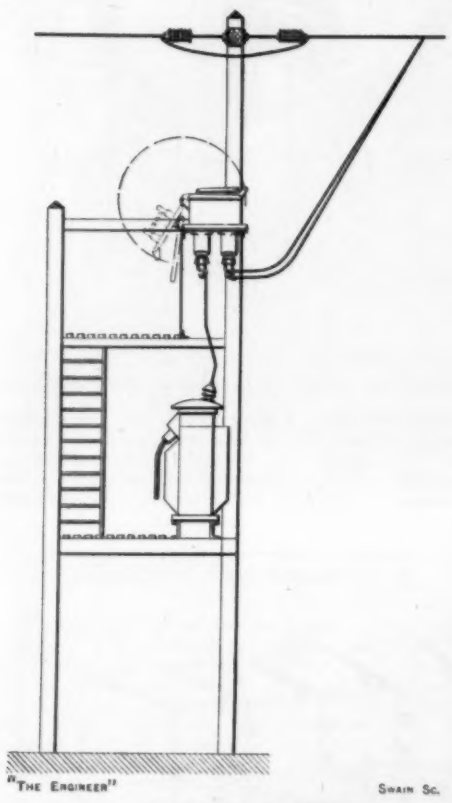


FIG. 11—POLE TYPE SUB-STATION

centre pillar type, mechanically operated by handles fixed on the upright supports.

A more simple form of sub-station is shown in Fig. 7, which illustrates the lay-out of several sub-stations for 50 kV and 110 kV associated with a large hydro-electric scheme in New Zealand. The oil circuit breakers are bridged by air break switches in a manner similar to that shown in Fig. 6, but in that case the switches are of the oil break type, and they are mechanically operated from below. On the high-tension side the step-down transformers are connected in delta, which necessitated a cantilever projection to support the connections which could not be run direct, the connections at this point being shown in the small right-hand sketch.

A 22,000-volt sub-station lay-out is shown in Fig. 8. In this case the incoming feeder is protected by Beard Hunter gear, and the protective current transformer and metering current transformer for each phase are contained in one case. From the bus-bars two feeders lead away through oil circuit breaker equipment, one feeding a step-down transformer for local power supply, and the connections to this transformer are guided by the supporting insulators on the extreme right. The other feeds a rotary converter for a traction supply, and the connections from this pass up to the inverted cable box shown above the current transformers on the right, the cable then passing to an adjacent building. The oil circuit breakers used in this sub-station are illustrated in Fig. 3. An example of an outdoor sub-station with air break switches is shown in Fig. 9, which is a typical example of one of the 6600/33,000-volt sub-stations that are being built by the English Electric Company for Preston, Blackburn and Blackpool for the control of interconnectors between the main stations.

Pole type transformer sub-stations call for little description, for, as the name implies, the transformers are mounted on the transmission line poles, with or without an operating or inspection platform. The small power transformer is connected to the high-tension line through an oil circuit breaker or fuses, which are preferably oil immersed. On the low-tension side, a totally enclosed waterproof ironclad main switch and fuses may either be mounted on the

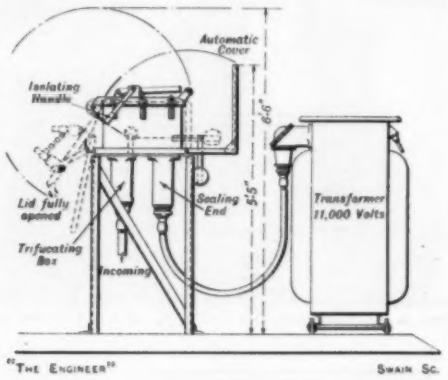


FIG. 13—SWITCH FUSE EQUIPMENT

pole or inside the consumers' premises, if they are reasonably near to the pole. An oil circuit breaker for pole mounting and operated from the ground by a hand pole is shown in Fig. 10, where it will be seen that the cable leads enter and emerge through bushings projecting downwards and that they terminate practically at the circuit breaker contacts. The pockets at the point of entry and exit are filled with compound. The oil tank is suspended by the maker's well-known patented spring suspension system which allows flexibility and cushioning on opening without the necessity for an air space above the oil in the tank. Absence of air in the tank prevents the formation of an explosive mixture on opening the circuit. A pole type sub-station with an operating platform is shown in Fig. 11, where the high-tension side of the transformer is controlled by an oil-immersed switch fuse with an automatic protection cover. Another type of small sub-station employing the oil-immersed switch fuse is shown in Fig. 13, which is practically a portable sub-station, as the sealing end attached to the transformer is of a special split type, having copper connecting links which may be removed when the cable portion is unbolted. The oil switch fuse and transformer may then be moved separately to a new site and the transformer sealing end reassembled without having disturbed any of the cable bonding. Lastly, Fig. 12 shows a portable kiosk sub-station mounted on a truck, and arranged for connection to an overhead transmission line through a set of outdoor isolating switches mounted on one of the transmission line poles. These kiosks can also be arranged for a cable connection and low-tension circuits with open type fuses on a slate board, the low-tension terminals being taken through the side of the kiosk to a waterproof box for cable connections to various machines.

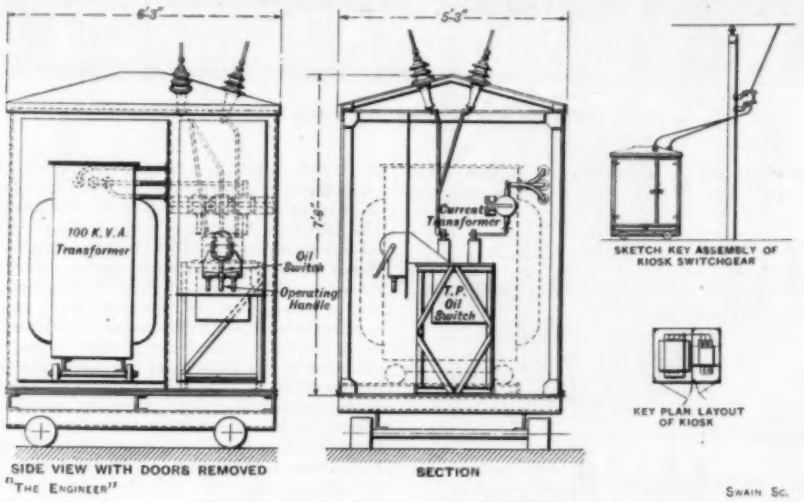


FIG. 12—PORTABLE KIOSK SUB-STATION

In Canada with the Empire Mining Congress.

(From a Delegate to the Congress.)

No. II.*

THERE is perhaps little need for me to describe the mighty Niagara Falls, which the party visited in the evening of the Hamilton trip, afterwards going under the Falls through the scenic tunnel, and before leaving seeing the scene illuminated by searchlights from the Canadian side. It is a marvellous sight, but one was led to pray for some accident to destroy the ugliest pile of buildings that ever an aluminium company erected to defile the work of Nature! Leaving the train in the afternoon to motor to Niagara Falls, I passed over the Queenston-Chippawa Power Canal, a large concrete conduit which deflects the waters of the Welland River, together with much from the Niagara River, 12 miles across country, down a total fall of 305ft. to the power station at Queenston, about 7 miles from the Falls on the Lake Ontario side, enabling the Hydro-Electric Power Commission to secure an additional 500,000 H.P. At Niagara Falls itself we visited the Ontario power plant, producing 183,650 H.P., and the Toronto power plant, with an output of 147,450 H.P., and in travelling over the southern portion of the province we had frequent views of the high-tension transmission lines, which carry power at from 90,000 to 110,000 volts from these plants westward 223 miles to Windsor and north-eastward 72 miles to Toronto. There are large transformer stations both at Niagara Falls and at Hamilton, and Toronto has four of them in various parts of the city. The potential energies of Niagara Falls are estimated at over 5,000,000 H.P., but the diversion of water for power purposes is limited by treaty between the United States and Canada. The construction in the bed of the Niagara River of a number of artificial islands is being advocated by engineers of the Ontario Hydro-Electric Power Commission, as it is calculated that it would be possible in this way to restore the scenic beauties of the Falls, whilst at the same time permitting a revision of the treaty in the direction of a larger diversion of water for purposes of power production. I believe it is reckoned that nearly double the present output could be secured. The sight of numerous wrecks in the stream above the Falls was, however, eloquent testimony to the audacity of the proposed construction works in the river current.

Leaving Niagara Falls at midnight, we found ourselves at breakfast time at Port Colborne, on Lake Erie, where there is a number of important industries, including the plants of the International Nickel Company (refinery), the Canada Furnace Company, Ltd. (foundries), the Maple Leaf Milling Company (the largest flour mill in the British Empire), and a great 3,000,000-bushel grain elevator. Port Colborne is, furthermore, the entrance of the old Welland Canal and of the new Welland Ship Canal, the construction works of which I witnessed both here and at other points during my motor or train journeyings in the Niagara Peninsula. The canal pierces one of the world's most important barriers to navigation, the significance of which is constantly growing as the population and trade of the Middle West expands and seeks an outlet to the Atlantic. The first Welland Canal was begun in 1824, and was equipped with forty wooden locks, each 110ft. long. Both in 1845 and in 1882 very extensive alterations were made. In the new canal the difference in level between Lake Erie and Lake Ontario, 325½ft., will be overcome by a series of seven lift locks, each 800ft. long, or more than seven times the length of the original locks seen by us from the train; the width of the original lock, 22ft., will have grown to 80ft., while the depth over the lock sills will be 30ft.

It is expected that the capacity of the new canal will provide for marine development for many years to come, whatever may be the outcome of the negotiations between the two North American Governments relative to the Great Lakes–St. Lawrence waterway. The new route also takes a straighter course between the two lakes, thus reducing the distance from 27½ miles to 25 miles, the entrance from Lake Ontario being now at Port Weller instead of at Port Dalhousie, as formerly. The estimated time required to pass a loaded freight vessel through the entire ship canal will be eight hours, as compared with fifteen to eighteen under present conditions with much smaller vessels, necessarily. Several vessels can also be locked through at one time. The plans provide for the construction of a new aqueduct at Welland, harbour improvements at Port Colborne, several bridges, &c. Out of the estimated total cost of 120,000,000 dollars nearly half has already been spent.

The canal crosses the north (facing Niagara) escarpment at the town of Thorold, and three of the locks are twin locks in one flight with a total lift of 139½ft. They are similar to the Gatun locks on the Panama Canal, which, while of somewhat larger dimensions, have an aggregate lift of 85ft. only. The combined height of two of these locks is only 28ft. less than that of the Horseshoe Falls at Niagara. The canal will be 200ft. wide on the bottom with a depth of 25ft. (and

* No. I. appeared November 11th.

later, if necessary, 30ft.). The tonnage passing through the present canal increased from 620,000 tons in 1901 to nearly 6,000,000 tons in 1925.

My own visits at Port Colborne were confined to the mill of the Maple Leaf Milling Company, Ltd., a thoroughly up-to-date plant in every respect, and to the refinery of the International Nickel Company. The latter plant has a 350ft. stack, which is the landmark of the neighbourhood, and the refinery was completed in 1918 for the production of nickel and copper from the matte produced at the Sudbury smelter in Northern Ontario. It occupies a site of 330 acres with a frontage of nearly a mile on Lake Erie, where deep-water transportation facilities are available in addition to those provided by the Canadian National Railway branch line. The works include a complete power plant, a water supply system, a separate sewerage system, an electric conduit distribution system for power and lighting, as well as piping systems for steam, oil and compressed air. All piping and cables are carried underground, so that there are no obstructions between the buildings.

The metallurgical processes employed include both chemical and electrolytic, the latter securing the recovery of the platinum metals present in the matte. There are four blast-furnaces for smelting the nickel-copper matte, four converter stands, eleven roasting furnaces, and three refining furnaces. One of the most modern Cottrell electrostatic precipitation plants for the treatment of flue gases is provided. It consists of seven treaters conveniently placed in relation to the main flue, so that any portion of or all the gases can be subjected to the process or discharged directly to the chimney. The total capacity of the refinery is 48,000 tons of matte per annum, producing 24,000 tons of refined nickel and 12,000 tons of refined copper. The electrolytic refinery has recently been enlarged to a capacity of 1,000,000 lb. of refined nickel a month.

Returning to Toronto in the afternoon, the Congress party spent a pleasant evening at the Canadian National Exhibition—Canada's annual Wembley—and after a quiet Sunday found itself on Monday morning at Sudbury, in the northern Ontario nickel field, an area of 550 square miles of rocks devoid of vegetation, owing to the acid fumes from the smelters. The first visit made was to the Creighton mine, which has to its credit a total production to date of 12,000,000 tons, with known reserves for many years to come, even at its present annual production of 700,000 tons. The workings, started as open-pit, are now underground, and ore is trammed by storage-battery locomotives, dropped through an ore-pass to underground crushers at the loading stations, whence it is hoisted to surface in 9-ton skips. Natural ventilation supplies ample air for the deepest workings—now over 2000ft. deep vertically. In the rock house at the shaft head we saw the ore crushed, hand picked and screened to main products, coarse and fines. Waste rock accounts for 15 per cent. of the hoisted material, the remainder being 60 per cent. coarse and 40 per cent. fine, all being about 1·5 per cent. copper and 4 per cent. nickel. At the Inco smelter, to which we were taken by train, we saw the ore being roasted, smelted in blast and reverberatory furnaces, and enriched by blowing in basic converters. The matte from these contains about 80 per cent. copper-nickel, and about 0·3 to 0·5 per cent. iron.

At the Coniston smelter in the afternoon we saw the washing of the crushed low-grade ore on tables. The rock product produced is ground very fine in tube mills and treated in flotation machines, where most of the remaining sulphide is floated out with it. In the sintering plant the fine smelting ore from the crushing mill, together with the sulphide from the washing and flotation processes and any flue dust from the blast-furnace and converter flues, is sintered into lumps. In the blast-furnace this sinter, together with coarse smelting ore and coke and lime, are smelted to form molten slag and furnace matte, the latter containing about 15 per cent. of nickel plus copper. This is ladled molten into the converters, into which air is blown to produce Bessemer matte, containing about 82 per cent. nickel, plus copper, this being barrelled and shipped to the Clydach refinery in Wales. The sulphuric acid plant produces acid by the contact process from the waste converter gas, the main difficulty experienced being that of finding a Canadian market for the output.

The following day found us at Cobalt, from which town we took train to Silver Centre on the South Lorrain branch of the Temiskaming and Northern Ontario Railway. Visits were made to the mines of the Mining Corporation of Canada, both to the underground workings and to the surface plant, where wet concentration and oil flotation of low-grade ores were being carried on, high-grade ore and concentrate being sent from here to Deloro, Ontario, for refining. In the course of the morning, we were taken to Ragged Chutes to see the Taylor hydraulic air compressor plant of the Northern Ontario Light and Power Company on the Montreal River, 8 miles south of Cobalt. The plant is practically automatic, air compression being effected by the direct action of falling water, trapping particles of air in its descent, and afterwards liberating them in a confined chamber under pressure. The compressor has a capacity of 5500 horse-power under a 50ft. head, and is believed to be the largest natural air compressor in the world. The dam across the river is 660ft. long, and at the intake gates are twin 16ft. intake heads, to each of which is fitted sixty-six air intake pipes 14in. in diameter. These heads are maintained at a height which slightly submerges the tops of the smaller intake pipes by means of vertical pneumatic lifts operated by compressed air piped from the air mains. The falling water draws air in through the small pipes, and thus in its descent of 350ft. it becomes a mixture of water and compressed air. The water intake pipes are reduced to a diameter of 8ft. 6in. immediately below the spider; 40ft. from the bottom of the shaft the diameter is increased to 11½ft. This increase in diameter tends to lessen the velocity and to liberate the air. Two steel-sheathed concrete cones receive the full impact of the water and direct it to a horizontal tunnel following the flow of the river. The tunnel is 1021ft. long, 22ft. wide, and at the bottom of the intake 26½ft. high, while near the foot of the tail shaft it is 42ft. high. From this highest point in the roof of the tunnel a 24in. steel pipe conducts the air to the surface and into the 20in. main that serves the mines of the Cobalt district. The upper part of the tunnel acts as an air receiver and reservoir. The water, after losing the trapped air, passes out to the river again through a discharge shaft, the point of the discharge being 48ft. lower than the collar of the intake shaft. In the tunnel, the air is compressed to 125 lb., and is remarkably free from moisture. The heat of compression is absorbed by the water without noticeable effect on its temperature. The 20in. main of seamless flanged steel pipes manufactured in Germany, is made up in 40ft. lengths, each length weighing about 3000 lb., and is anchored to heavy concrete piers on rock foundations at half-mile intervals. Half-way between each two piers an expansion joint is fitted.

At Cobalt in the afternoon we visited in small parties a number of the milling plants at which ore, delivered by surface or aerial tramways, was being concentrated by water tables, followed by oil flotation or cyanidation. The remainder of the day was spent at the charming brick-built town of Haileybury, where tea was served at the golf pavilion overlooking Lake Temiskaming.

Power for these mines and milling plants, by the way, is entirely from hydro-electric developments, the entire nickel, silver and gold-mining country being served by a linked-up system controlled by the Canada Northern Power Corporation. Eight water-power developments of a total capacity of 86,270 H.P. and an ultimate capacity of 135,470 H.P., are linked up by 750 miles of transmission line and 125 miles of distribution line to serve this district and the neighbouring mines in the Rouyn area of Quebec. Cobalt and South Lorrain, in particular, are supplied mainly from two plants on the Montreal River, and one on Matabitchuan River, having a combined capacity of 21,300 H.P. The total silver production of the district from 1903 is in the neighbourhood of 400,000,000 fine ounces.

To the Kirkland Lake and Porcupine gold-mining districts, then, for two days, the morning of the first day being spent by me at the Kirkland Lake mine, which has a depth of 2475ft., the deepest horizon reached in the camp. As a general rule, in this camp ore is broken from breasts in shrinkage stopes and trammed in cars by hand. Some of the mines, however, have storage-battery locomotives for handling ore. Hoists, in some instances capable of operating to 3000ft., are driven by electric motors and broken ore is hoisted in 1-ton cars in most instances. At the Lake Shore mine, crushing is done underground on the 800ft. level, and ore is hoisted in 3-ton skips from a loading pocket on the 900ft. horizon. The two largest hoists in Canada are installed in the central shaft of the Hollinger mine, these having a capacity of 560 tons each per hour from a depth of 3200ft., or 12,440 tons a day, which is more than double the present mill capacity. Diamond drilling is used very freely in this district. Electric locomotives of the storage-battery type are used for underground haulage on the three biggest mines, and, in addition, on the Hollinger, electric trolley locomotives on all levels below the 425ft. Very little artificial ventilation has been found necessary.

Concentration, in both the Kirkland Lake and the Porcupine camps is by the "all-sliming" cyanide treatment, with variations to suit local conditions. The district uses hydro-electric power, as already described.

At Timmins we bid good-bye to the "Green" Train taking the delegates booked for the eastward Tour 'B," and these went eastward from Cochrane to Rouyn, Arvida, Quebec, Thetford Mines and so on to Sydney and Newfoundland. The "Blue" and "Red" Trains, however, proceeded from Cochrane westward to Hudson and Minaki, where aeroplane parties set off to visit the Long Lake gold mines in Central Manitoba and the Great Falls hydro-electric power plant of the Manitoba Power Company. This plant, producing 168,000 H.P., is the largest single installation in Manitoba, and will consist eventually of six units of 28,000 H.P. each, four of which—112,000 H.P.—are now installed. The transmission line to the Central Manitoba mines is 43 miles long, but the Manitoba Power Company has its main outlet for energy in the city of Winnipeg and neighbourhood. The company develops power with a head of 56ft., and the Winnipeg River has other power plants, the total output of which, together with that of Great Falls, is in excess of 200,000 H.P.

After a very enjoyable two days in Winnipeg, the Congress trains moved off south-westward to Estevan, where we were enabled to inspect a number of the lignite collieries of south-eastern Saskatchewan, including, *inter alia*, the Western Dominion Collieries, which have recently been reorganised with English capital to enable them to take over the carbonising and briquetting plant of the Lignite Utilisation Board. Upon this plant, which we inspected, the Governments of the Dominion and of the Provinces of Manitoba and Saskatchewan have together spent 1,000,000 dollars in a vain effort to develop a commercial process of briquetting the local coal to enable it to stand transportation to the Winnipeg and other markets, now largely dependent upon American coal. It remains to be proved whether the English process now to be installed will achieve any greater success, and the district is naturally keenly interested in the outcome of the new developments. The Saskatchewan Government is now engaged upon an investigation to examine the feasibility of setting up an electrical power supply scheme, based upon the coal mines of the south and the water powers of the north. The successful utilisation of the Estevan coal is therefore of great importance to the province, quite apart from its use as a domestic fuel, and as the district has an estimated coal reserve of 9,000,000,000 tons, comparatively easily mined at shallow depth, manufactures of various kinds will probably be started there on a considerable scale. The province as a whole is stated to be underlain by coal to the extent of no less than 4000 square miles.

(To be continued).

SIXTY YEARS AGO.

Sixty years ago it was beginning to become evident to many engineers that Bessemer steel was not all that those interested in its manufacture and sale claimed it to be. The "new material," as it was still called had been extravagantly lauded and many had been induced to believe that Bessemer metal, or at any rate steel of some kind, could take the place of iron in the construction of ships, guns, armour plates, shot, girders, locomotives and rails. Writing in our issue of November 15th, 1867, we said that in nearly every instance the anticipation had been disappointed. The use made of steel in shipbuilding continued to be very small; steel guns were things of the past; we had little to hope from steel for armour plates; and girders, boilers and locomotives continued, and apparently would continue, to be made of iron. Only as a material for rails had steel succeeded in any way commensurate with its advocates' hopes. Even in that direction, however, it was not clear, we held, that the material had definitely established its claim to respect. Apart from the fact that steel rails were much more expensive than iron rails—£12 to £13 per ton, as compared with £5 15s. to £6—we argued that the peculiarities of steel were not fully understood. Our knowledge of its behaviour under certain conditions was as nothing compared with our knowledge of iron. So far, very few Bessemer rails had been in use long enough to supply information of much value regarding the changes which occurred in the metal under the impact of heavily loaded wheels. In one case the facts revealed were directly in disfavour of the use of steel. The instance referred to was described as that of "the famous Chalk Farm rail," a Bessemer rail which had failed most unexpectedly by breaking into three sections under little apparent provocation. After a short, hard life, the metal of that rail had changed from being tenacious and fibrous to a crystalline and brittle character. In the course of the next two years or so, we anticipated that other Bessemer rails might fail similarly from a similar cause. We accordingly urged engineers to pause before they took into their service a material that might play them false at any moment. If Bessemer rails were used freely, we might, for anything known to the contrary, be setting a network of pitfalls all over the country which would produce a heavy crop of accidents in a few years' time.

B.E.S.A. SPECIFICATIONS.

PAINT MATERIALS.

The British Engineering Standards Association has just issued three British standard specifications for Brunswick or chrome green oil paste for paints, Indian reds (pale, middle and deep) for paints, and black oxide of iron for paints. These new specifications contain clauses regulating the composition, standard reception tests for the purchase of these materials, and appendices giving methods of carrying out the tests. They have been prepared at the request of the paint manufacturers by a committee representative of both the buying and manufacturing interests, and as in the case of all British standard specifications, they will be reviewed as experience of their working, or progress in the industry, renders it necessary, and revised issues will be published from time to time. Copies of these three new specifications—Nos. 304, 305, and 306, 1927—can be obtained from the British Engineering Standards Association, publication department, 28, Victoria-street, London, S.W. 1, price 2s. 2d. each post free.

Asked as to the future of the Departments—which includes the Ministry of Transport—to be closed down for reasons of economy, Mr. Baldwin stated last week that it would be more convenient if he made a statement on the subject later in the session.

Commercial Motor Vehicle Exhibition at Olympia.

No. I.

THE eighth Exhibition of Commercial Motor Vehicles, which opened at Olympia to-day, Friday, and will continue for ten days, bids fair to rival in interest the show of pleasure cars which was held in October last in the same building. No such exhibition has been held since 1925, and in the intervening time probably more progress has been made in the design and construction of heavy passenger and goods machines than in any similar previous period. The range of vehicles on view represents the products of builders not only in Great Britain, but on the Continent, in Canada, and the United States of America. The numbers of exhibitors in the different sections are as follow:—Vehicles and body work, 106; accessories and components, 205; tires, 18; and garage equipment, 16. The exhibits include motor vehicles for the carriage of all classes of merchandise; omnibuses and motor coaches incorporating the latest improvements in design and construction for the safety and comfort of passengers; vehicles to comply with the requirements of municipalities; railless traction vehicles; steam wagons; and electrically driven machines. Particular interest attaches at the present time to the six-wheeled machines with four and in some instances all six wheels used for driving purposes. The British Government, through the War Department, is mainly responsible for this latest departure, having taken out patents for a rigid-frame six-wheeler which is now familiar to all interested in the subject. It is prepared to grant licences to builders to take up this type of machine, and will subsidise users. For cross-country transport such as is met with in military uses this machine has proved itself admirable, but for ordinary road transport the extra cost of construction and maintenance of the six-wheeled machine is not generally considered to be justified, although many are in use as omnibuses.

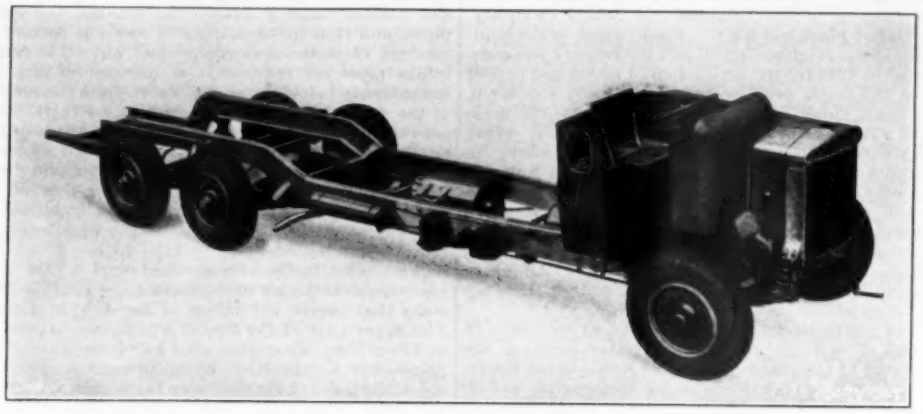


FIG. 1—SIX-WHEELED PETROL-ELECTRIC CHASSIS—TILLING-STEVENS

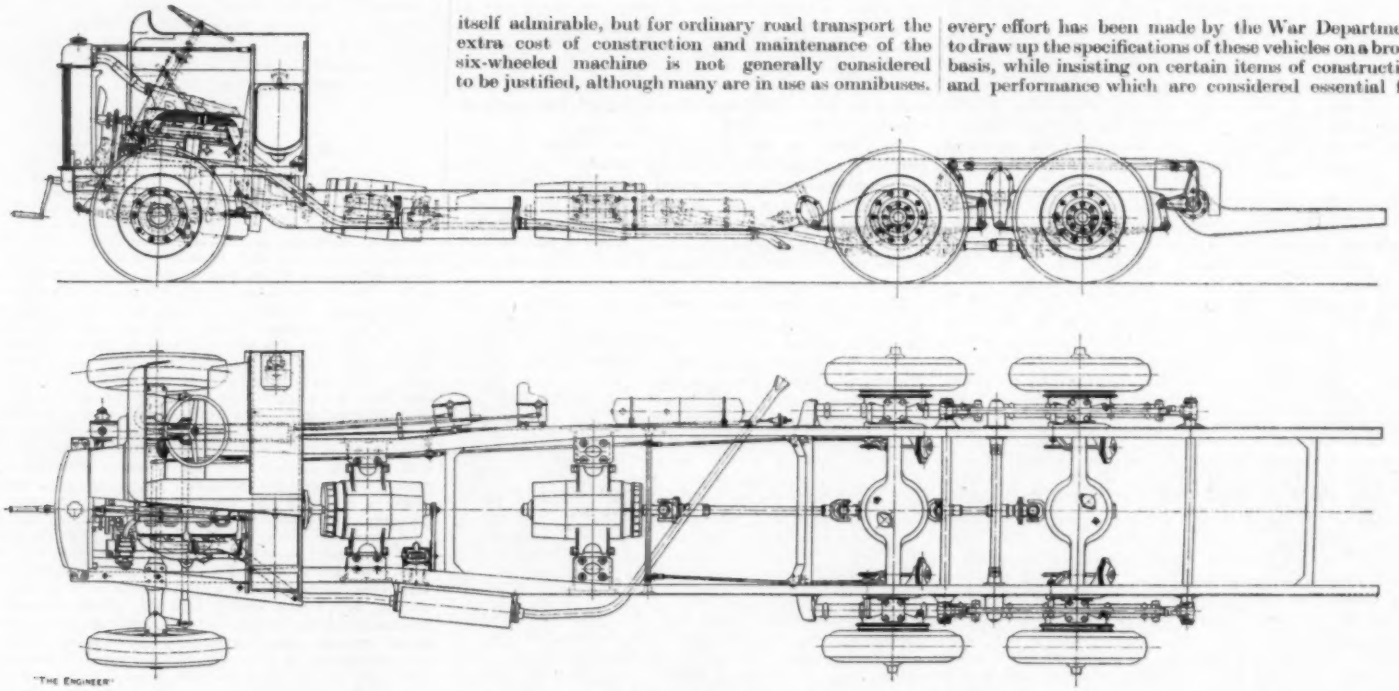


FIG. 2—36-95 H.P. SIX-WHEELED PETROL-ELECTRIC CHASSIS—TILLING-STEVENS

In the paper which Captain Kuhne read before the Institution of Mechanical Engineers last year on "Load-carrying Vehicles in the Army," he indicated the lines on which the War Department was working in order to popularise this class of machine for commercial purposes. The War Department is naturally anxious to see on the road and in commercial hands large numbers of vehicles of the same types which the Army uses in times of peace, and which can be taken into the service of the Army in the event of mobilisation. With this object in view every effort has been made by the War Department to draw up the specifications of these vehicles on a broad basis, while insisting on certain items of construction and performance which are considered essential for the needs of the Army. To what extent the builders and users of these machines are co-operating with the War Department can be seen at Olympia.

FIG. 3—SIX-WHEEL DRIVE CHASSIS—F.W.D. LORRY COMPANY

The expansion which is taking place in the heavy branch of the self-propelled road vehicle industry is shown by the fact that, as against a total of 140,000 commercial goods and passenger vehicles in use in this country in 1920, the number of these machines is now 400,000, according to the returns of the Ministry of Transport. The recent issue by this authority of the Heavy Motor Car (Amendment) Order marks a period in this development, and the exhibits generally embody the constructional requirements specified by the new regulations. The Society of Motor Manufacturers and Traders, which is promoting the Exhibition, is collaborating with the British Cycle and Motor Cycle Manufacturers' and Traders' Union in order to make the Show attractive to every potential user of road motor transport, and with this co-operation the exhibits comprise machines with capacities ranging from 2 cwt. to 15 tons and more. Another feature of the Exhibition is a series of conferences at which subjects of interest to both the users and builders of commercial vehicles will be discussed. A further important section of the Exhibition is that of garage equipment. This department embraces a very wide range of appliances from split pins to breakdown equipments for lifting and hauling the heaviest of vehicles. Washing plants are shown in this section which are capable of turning the average chauffeur green with envy.

The builders of these heavy passenger-carrying vehicles are at present in a much more fortunate position than most of the light car manufacturers as regards prices. Competition is not so keen, and as municipalities have long purses, the makers of public service vehicles can demand a fairly substantial profit on their wares.

SIX-CYLINDER SAURER.

Turning to the individual exhibits, extreme pressure on our space permits only reference to some of

the most original. One of the most attractive chassis in the Exhibition is undoubtedly that of the new Swiss-built six-cylinder Saurer. This chassis has been designed for passenger vehicles, and with that object has a low frame. The engine has cylinders 110 mm. bore by 150 mm. stroke, giving an output, we are informed, of 105 horse-power at 1600 revolutions per minute. The engine is a beautifully clean design, and has a detachable cylinder head, which carries the valves, these being operated through push-rods and rocker levers from the cam shaft. The crank shaft is carried in seven roller bearings and has a damping device at the front end to eliminate vibration. A special light metal is used for the pistons. The carburetter is of special design, with only one moving part, namely, a butterfly throttle. It is heated by an exhaust jacket, and a governor of the centrifugal pattern limits the revolutions of the engine to 1600 per minute. The engine and gear-box are in one unit, suspended, at three points only, by rubber sleeves. The gear-box is bolted concentrically to the engine crank case, and requires no further support. The clutch is of the multiple dry plate pattern and four forward speeds and a reverse are provided. In order to bring the body floor as low as possible, the back axle is cranked as well as the frame. Power transmission is effected by means of bevel gearing, thence through differential shafts which have universal joints interposed, and finally by means of an internal spur wheel drive with oblique teeth situated inside the rear wheel. The torque and drive are taken by the rear springs. Braking is effected by hand and foot, the former acting on the rear wheel, and the latter on all four wheels. There is also an engine brake. The wheel base is 19ft. and the length of chassis 29ft. 6in.

Steam Vehicles.

There are not many exhibits using steam as the motive power, and most of them have already been described in The Engineer. The Yorkshire Patent Steam Wagon Company, Leeds, is represented by a 6-ton wagon with a flat lorry body. This machine has the familiar double-ended locomotive type boiler and superheater, and a vertical two-cylinder compound balanced engine, with double high-pressure intercepting valve. Clayton Wagons, Ltd., Lincoln, show steam wagons of both the over and undertypes, the latter having a vertical water-tube boiler and the former a locomotive type of boiler. The pressure used in the water-tube boiler is 260 lb. per square inch, and that for the locomotive boiler is 230 lb. per square inch. The Sentinel exhibits are referred to at some length later. Fodens, Ltd., Sandbach, show a rigid six-wheel covered lorry capable of carrying 6 tons, or 10 tons with a trailer. The engine is 45 brake horse-power, and has compound cylinders, 4½in. and 7in. bore by 7in. stroke. Atkinson Walker Wagons, Ltd., Preston, are exhibiting a 10-ton articulated six-wheeled steam wagon propelled by a uniflow engine of 40 nominal horse-power. This engine has twin cylinders, 7in. bore by 10in. stroke, and the load capacity of the machine is said to be 10 tons.

Tilling-Stevens Petrol-Electric Chassis.

Tilling-Stevens Motors, Ltd., of Maidstone, are exhibiting a 36–95 horse-power six-wheel petrol-electric chassis, illustrated in Figs. 1 and 2, which is fitted with pneumatic tires and capable of carrying a load of 7 tons including the body. The four-cylinder engine has a bore and stroke of 4½in. by 6in. respectively, giving an R.A.C. rating of 36·15 horse-power. The cylinders are cast *en bloc* and the detachable cylinder head is formed in two halves. Side-by-side valves are employed, the valve and cylinder head arrangement being made under Ricardo patents. The crank shaft is carried in three white metal bearings and the cam shaft is driven by helical spur gearing. Lubrication is effected by means of a gear type pump driven off the cam shaft by skew gearing, and oil is fed under pressure to all the bearings. Magneto ignition is employed and the mixture is provided by a Zenith carburetter. Circulation is carried out by a water pump. The electrical transmission equipment is of new design and is constructed so as to allow of a low loading line to the chassis. The power of the engine is transmitted to a dynamo supported by two brackets on the main frame, and the motor is similarly mounted. The dynamo and motor yokes are octagonal in shape. The final drive is made by open propeller shaft to worms slung beneath both axles, there being roller bearing type universal joints in each shaft. The springing of the rear axle is interesting. Each axle is provided with two semi-elliptic springs, and in order to obtain interaction between the two axles the rear end of the spring of the leading axle is connected by links, bell crank levers and a connecting-rod to the rear end of the spring of the hind axle. By this method a greater spring length is obtained at the expense of a few moving parts and joints on each side. A constant voltage lighting set is fitted, the output of the dynamo being rated at 12 volts, 350 watts. The chassis is arranged for forward control and its approximate weight is 4 tons 10 cwt.

The other exhibit of this firm is a light omnibus having a low-line chassis. The engine is similar in design, but smaller than that fitted to the six-wheel chassis, and consists of a four-cylinder side-valve engine, having a bore and stroke of 4½in. by 5in., giving a Treasury rating of £29. The transmission is of the ordinary type, the drive being taken through a single plate fabric clutch to a four-speed gear-box. The final drive is effected by means of an under-slung worm-driven rear axle. The chassis is arranged for forward control and is capable of carrying a load of forty passengers plus a body allowance of 2 tons. The weight of the chassis is approximately 3 tons and the frame height when loaded is 2ft. 2in. We understand that this firm will shortly produce a six-wheel vehicle fitted with the usual drive.

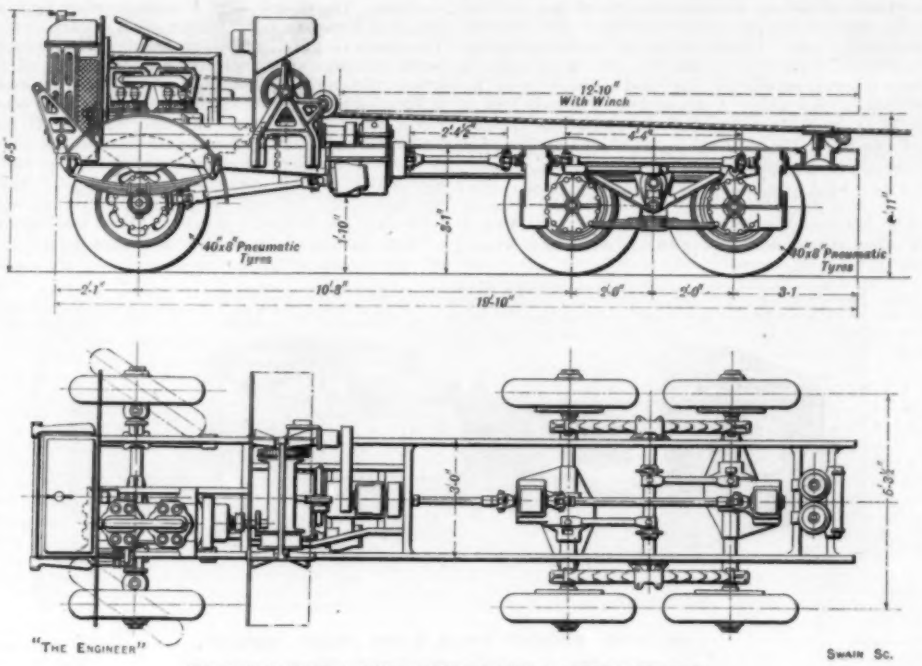


FIG. 4—SIX-WHEEL DRIVE CHASSIS—F.W.D. LORRY COMPANY

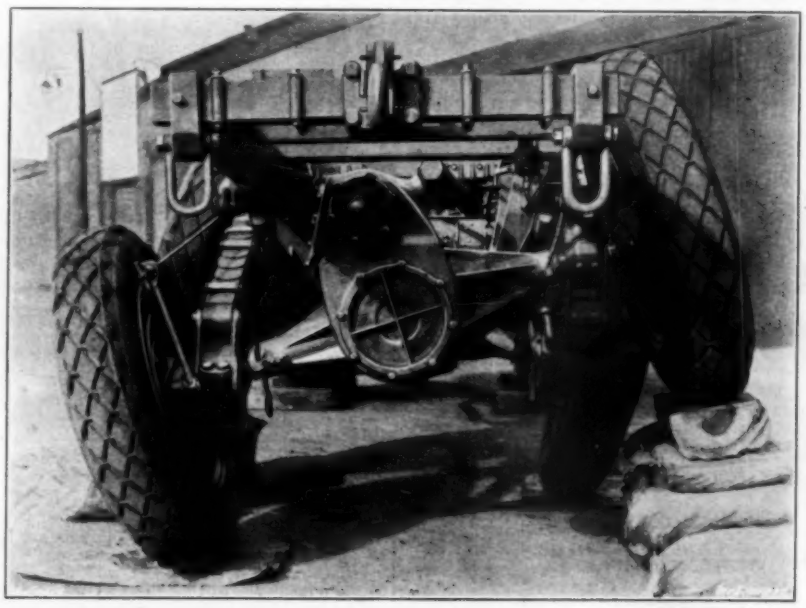


FIG. 5—REAR VIEW OF SIX-WHEEL DRIVE CHASSIS—F.W.D. LORRY COMPANY

F.W.D. Co. Six Wheel Drive Vehicle.

The Four-Wheel Drive Lorry Company, Ltd., of London, has on view a six-wheel vehicle driving on all wheels, illustrated in Figs. 3, 4, and 5. It embodies many particularly interesting features in the lay-out of the transmission. On good roads, when four wheels would provide sufficient adhesion, the drive to the front wheels may be disconnected by means of a lever in the driver's cab. The chassis is designed for carrying loads, including the body, of 6 tons 15 cwt. on good roads, and 4 to 5 tons on cross-country work. A four-cylinder engine having a bore and stroke of 5½in. by 5½in. respectively and a rating of 42 horse-power provides the motive power. Ignition is effected by high-tension magneto and a Solex carburetter is provided. A centrifugal pump and a very large radiator provide for cooling. The drive is taken through a Hele-Shaw multi-disc clutch running in oil to a reducing box which consists of an aluminium casing, registering into the front end of the main gear-box. This is of the constant-mesh type, giving three forward speeds and one reverse. The drive to the rear axle is taken from the end of the main shaft, and for the front axle drive an intermediate shaft is fitted, this being provided with a sliding gear engaging with a fixed gear on the main shaft. The drive is then taken through this intermediate shaft to a further shaft by means of skew gears, giving an inclination to this final shaft which brings it into line with the front axle. In order to make the distance between centres of the universal joints connecting the two rear axles as long as possible, bevel driven rear axles are employed, in which the pinions are on opposite sides of the axles, as shown in the drawing Fig. 4. Mounted on the axles above these pinion shafts and parallel to them are two further shafts, which are connected to the pinion shafts by chain reduction gearing. The drive from the gear-box is taken by means of a propeller shaft to the front end of the upper shaft of the front bogie axle and thence by chain to the pinion as before mentioned. The propeller shaft is continued through this casing to another shaft which conveys the drive to the second casing of similar construction, also containing a chain reduction gear, there being no differential between these two axles. Although these axles are 4ft. apart the length between the universal joints is 4ft. 7in. The advantage gained by this construction is that the universal joint wear is reduced to a minimum while permitting a greater difference in the levels of the two axles. It also reduces the likelihood of one wheel or axle being suspended in the air when travelling over bad ground. The rear axles are of the full floating bevel type and the total reduction obtained is 1 to 2·9. The complete differential, with the exception of the pinions, are interchangeable between front and rear axles. There is no chain reduction gear in the front axles, this being compensated for by a skew gear reduction in the gear-box. The suspension of the

rear axles is of the W.D. type, shackles being mounted on the axles by means of trunnion bearings. They are free to slide outwards on the axles, but are held central by the shackles bearing up against a collar on the axle casing ends. The axle shackles are connected together with two wide springs on either side, these springs being connected together at their centres by a stiff cylindrical steel casting, pivoted on a cross tube held in brackets. These latter are rigidly attached to the frame and are stayed diagonally to it. Torque rods connect the axles to a cross channel fitted into these brackets. Two independent brakes are fitted. The foot brake acts upon a drum mounted at the rear end of the gear-box main shaft, and is of the external contracting type. It acts on all six wheels when the front wheel drive is in operation. The hand brake is of the internal expanding type, and operates upon the four rear wheels only. A strong towing attachment of the W.D. type is fitted at the rear end of the chassis, and provision has been made for the mounting of a winch at the rear of the driver's seat.

Sentinel Six-Wheel Wagon.

The Sentinel Waggon Works, Ltd., is exhibiting a six-wheel vehicle in the shape of a 15-ton steam wagon

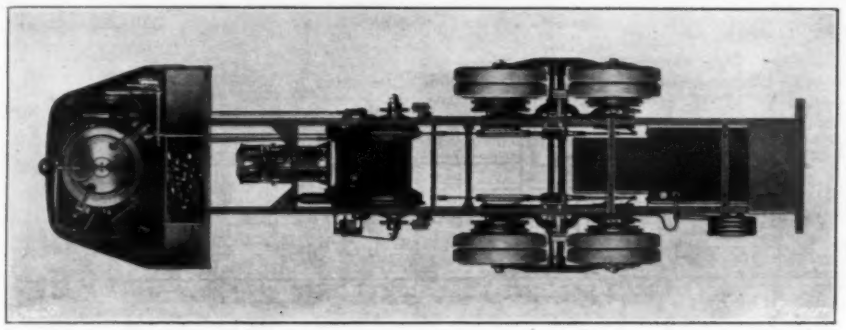


FIG. 6—SIX-WHEELED STEAM WAGON CHASSIS—SENTINEL

illustrated in Figs. 6 and 7. The construction of the bogie is interesting in that it consists of a hollow axle having two sets of arms, the extremities of which carry stub axles in a parallel plane to the central axle. The front wheels of the bogie are driven from the engine by two chains and the rear wheels of the bogie are driven from the front pair in a similar manner, there being ample provision for taking up chain slackness. The effect obtained with this bogie is that the four wheels are enabled to pivot in two independent groups about the central axle, each wheel having a maximum movement of about 7in. up or down. Compound semi-elliptic springing is adopted for the bogie, the light loads being taken by supple springs and the heavy loads by subsidiary springs bearing on special spring pads. The torque of the bogie is taken by two radius rods forming a connection between the forward pair of wheels and the engine suspension plates, thus assuring correct chain tension. The boiler and driver's cab conform with the firm's usual practice. The engine, gear-box and differential form one unit and are suspended underneath the frame by three-point suspension. The engine develops a maximum of 90 brake horse-power at a boiler pressure of 275 lb. per square inch, and the makers claim an efficiency of 16 lb. of steam per brake horse-power hour. The two double-acting cylinders have a bore and stroke of 6in. by 8in. respectively and the crank shaft is carried in two stainless roller bearings. Driving flexibility is obtained by a three-position cam shaft giving cut-offs of 30 per cent., 40 per cent., and 89 per cent. respectively. Two forward speeds are provided, giving ratios of 7·2 to 1 and 4·88 to 1. Steam braking is provided for the four bogie wheels, the steam operating through a special cylinder on two shoes in each of the four drums, the pressure on the actuating pedal being so arranged as to make the resistance felt by the driver's foot on the brake pedal proportional to the amount the brakes are being applied. The other shoes in the drums are operated by both hand and foot.

Bean Six-Wheel Chassis.

A new production which Bean Cars, Ltd., are showing is a six-cylinder low-loading chassis for coach and omnibus work. The engine horse-power is 17·9 and bore and stroke 69 mm. and 120 mm. respectively. Cooling is carried out by the thermo-syphon method. The clutch is of the single-plate type and the gear-box has four speeds with centre control. The rear axle is fully floating, and is driven by spiral bevel gearing. The foot brake operates on all four wheels through the Dewandre system, and the engine is fitted with dynamo and starter. The new vehicle has a wheel base of 13ft. 6in. and track of 5ft. 7½in. The gross carrying capacity of this machine is 50 cwt. A 30-cwt. commercial vehicle by the same makers also makes its first appearance at Olympia. Among the distinctive features of this vehicle are an engine with the Ricardo design of cylinder head and induction system, with special cam and valve port design. This engine develops over 40 H.P. on the brake, and enables a high speed to be maintained without stress or difficulty. There are no chain drives in the engine and accessibility is a feature. The clutch is of the single-plate type, and has a stop to ensure smooth and rapid gear changing. Accessibility is further helped by separate mounting of the gear-box, which has four ratios, the lowest being 25·3 to 1. The gear-box is coupled to the clutch by two fabric joints. The change-speed lever is at the right hand. As the rear axle is fully floating, it is relieved of all load other than the driving stress. This saves weight and enables the axle shafts to be withdrawn without even jacking up.

An Electric Omnibus Chassis.

In the electrically propelled section Ransomes, Sims and Jefferies, Ltd., Ipswich, show a six-wheeled electric trolley omnibus chassis on the Thornycroft bogie system, and an electric truck. The omnibus chassis is constructed to take a body having a seating capacity of sixty-sixty-eight people. The chassis is fitted with a 65 B.H.P. traction motor running at 1000 r.p.m. There are two armatures arranged within one casing, suitable for series-parallel control, and the motor is constructed to B.E.S.A. specification for traction motors. The chassis is mounted on disc wheels fitted with 40in. by 8in. pneumatic tires. Brakes are provided on all six wheels, and are operated on the Westinghouse air brake system, or, alternatively, by manual effort.

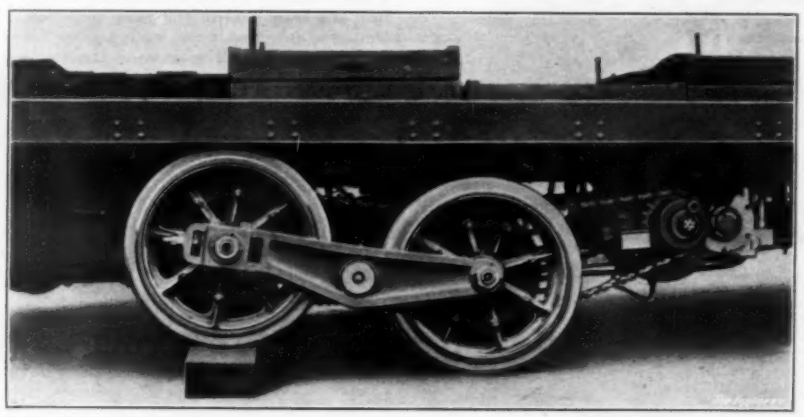


FIG. 7—BOGIE OF SENTINEL WAGON PASSING OVER OBSTRUCTION

(To be continued.)

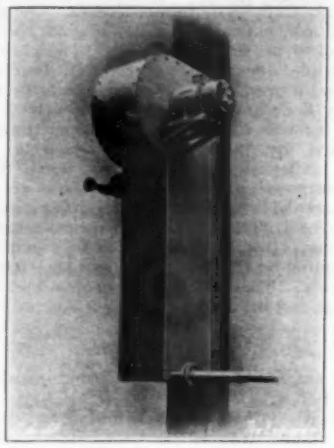
Preparations are going steadily forward for increasing the output of the Malagash Salt Mine, Nova Scotia—the only rock salt mining industry in Canada.

New Types of Unit Heaters.

Two new types of Unit heaters have recently been put upon the market by Musgrave and Co., Ltd., of Belfast. They are illustrated in the accompanying engravings, Figs. 1 and 2, the first of which shows what is known as No. 1 Unit and the other as No. 2.

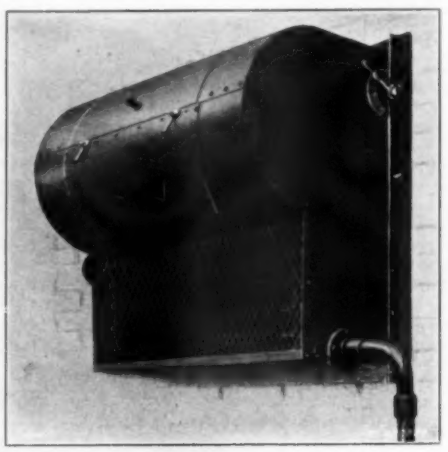
The makers point out that the heating of works, factories and warehouses is usually effected by a central heating system, with hot water, steam or warm air as the heating medium, the heat being distributed by means of piping or air ducts, and that in industrial buildings the arrangement of this piping may lead to difficulties, through the necessity of avoiding interference with belts, shafting, cranes or runways. Under such conditions, they urge, the Unit type of heater finds wide application.

In Messrs. Musgrave's view there is no doubt that, of the various types of Unit, the steam-heated Unit presents the greatest advantages, since a small pipe is sufficient



NO. 1 UNIT HEATER

to supply the full radiating capacity of a large unit, it is economical, clean, easily installed and controlled. Hence we find that their new Units are of that type. The No. 1 size Unit has been designed for bolting direct to the structural columns of a building. It comprises a single inlet fan which discharges in a downward direction behind a battery of gilled wrought iron pipes. The air passes outwards through this piping and through a wire mesh grill, which forms a delivery opening for the Unit. The area of this opening is made comparatively large, so as to give a low air velocity, in order that no unpleasant draughts may be set up. The fan runner is usually mounted direct on the spindle of an electric motor, though a belt drive may be arranged if desired. The gilled pipe heater is of welded construction throughout, so as to render it leak-proof, and an extended heating surface in a compact form is thus obtained. The Unit has a capacity of 1500 cubic feet of warmed air per minute, and is designed to give a total heat output up to 100,000 B.Th.U. per hour.



NO. 2 UNIT HEATER

Under normal conditions the inlet of the fan is open to the building in which it is situated, a constant re-circulation of air being thus maintained. It may, however be, and often is arranged with a suction connection to the outside air, so that fresh air may be drawn in.

The No. 2 Unit is generally similar to the No. 1, but is provided with two fans, the motor for driving being situated between them. This design is essentially for attachment to the walls of the building, and is usually arranged so that it may take either a fresh air supply through the wall, or, by means of a curved door in the upper part of the casing, it may re-circulate the air of the building to some extent. The same type of pipe heater is used as in the No. 1, but it is arranged horizontally instead of vertically.

The makers claim with regard to the single Unit system that it has considerable advantage over a central plant, by reason, first, of the ease with which it is installed, and, secondly, of its low cost. Moreover, the system is particularly flexible, the Units themselves being easily moveable, while, in the case of extension, additional units to meet the requirements may be put in. Furthermore their Units occupy no floor space at all.

Railway Matters.

In order to favour Swedish industry and Swedish labour, the State Railways some time ago placed a trial order of 1000 tons of rails with the Stora Kopparbergs Bergslags Aktiebolag Ironworks, the oldest industrial concern in the world, founded 700 years ago. The rails will be used in Gothenburg.

The Postmaster-General has arranged to install telephones for the use of the public at small rural railway stations throughout the country. It is not proposed to fix telephone booths, but the instrument will be in the custody of the railway staff—probably in the booking office—who will collect the money for the calls made.

In the Political Notes in *The Times*, it was intimated that a number of interesting subjects are to be raised in the Upper House. Lord Monkswell proposes that a public inquiry should be held into the record of the railway companies of Great Britain, with particular reference to whether during the century that railways have been in existence the progress in the facilities offered to the public has been reasonable.

The Belfast and County Down Railway Company, which is suffering severely from motor omnibus competition, has asked the Irish Railway Wages Board that it may be reduced from a Group I. to a Group III. railway, and thus be allowed to pay the lower wages found in the latter grade. The Tribunal would not agree to that step, but made an order that all salaries and wages be reduced by 10 per cent. for twelve months from the 1st inst. The question must then be reconsidered on the application of the railway company.

The pneumatic tamping or packing of sleepers is an established institution in the United States, although it has never found favour here, probably because it necessitates a portable compressor and other plant. An electrical tool has now been put on the market which can be operated, it is claimed, from a small compact portable petrol-electric power unit, weighing about one-fifth of that of a compressed air unit. It consumes 5 gallons of petrol for eight hours, has a range of 1250ft. from the power unit, and, it is further claimed, dispenses with three men out of every four in a gang.

An official statement of the London Electric Railways Company intimates that it is unlikely that the new Underground Station at Piccadilly-circus will be completed before the end of next year, Though the system of tunnels and subways connecting the booking hall with the platforms of the Baker-street and Waterloo and Great Western, Piccadilly and Brompton Railways has now taken definite shape in the ground and the great circular pipe subway is complete, work on the booking hall—and the underground circus of shops and show-cases which is to surround it—has not yet begun.

During the first quarter of the present year the assistant inspecting officers of the Ministry of Transport held fifty-six inquiries into the more serious accidents to railway servants, of which twenty were fatal cases. Of the latter, six related to permanent-way men and two to porters; one other man—a signal ganger—was killed whilst working on the permanent way. In ten of the fatal cases the cause given is misadventure, seven were due to want of care on the part of the deceased, one to want of care on the part of others, one to the man's "forgetfulness of his own safety," and one to a defective ladder. Seven of the fatalities occurred on the Southern, six on the London and North-Eastern, and five on the London, Midland and Scottish. The Great Western not only had no fatal case but none of injury.

The London and North-Eastern Railway has decided to open up two of the tunnels between Godley and Mottram Stations, on its main Manchester and Marylebone line. Such a course has been rendered necessary owing to the increased dimensions of present-day rolling stock and the need for four lines of rails on the section. The tunnels are 100 yards and 264 yards long, and are connected by a open cutting of 110 yards. They will be transformed into one continuous cutting by the removal of over 700,000 cubic yards of earth, which will be tipped on a site near the east end of the work. As the main road from Stockport to Glossop passes over the east tunnel a five-span brick and steel viaduct is included in the scheme. The contract has been let to Logan and Hemmingway, Ltd., and work will be commenced immediately.

A reply to the letter from Mr. Locket, mentioned in our last issue, appeared in *The Times* of November 1st by Mr. Selbie, of the Metropolitan Railway, in his capacity of chairman of the Railway General Managers' Conference. He wrote that local conferences have been set up, and that they are doing useful work. It was, in his opinion, desirable that they should continue their activities, but it was a matter of regret that in some instances they had not fulfilled the high expectations which were entertained at their formation. Mr. Dunwoody had suggested that better results would be obtained if the companies were willing to discuss "the larger questions which are vital to their mutual interests," but Mr. Selbie thought that "it is perhaps in part due to the desire of the conferences to discuss questions of a general character that they have not as yet achieved the success which was hoped."

The Ministry of Transport railway statistics for August last have recently been issued as a Stationery Office publication, price 3s. 6d. They show, when compared with August, 1925, a decrease of 6·6 per cent. in the number of passenger journeys and of 11·8 per cent. in the receipts from passengers. The passenger train mileage showed, however, an increase of 3·3 per cent., possibly owing in part to a larger mileage of light motor trains. On the other hand, there was a gratifying increase of 19·9 per cent. in the tonnage carried—the comparison is made with the August of 1925 and not 1926—towards which coal, coke and patent fuel contributed 27·3 per cent. The increase in freight receipts was 18·8 per cent. That was earned with an increase of only 9·6 per cent. in the freight train mileage, owing to the average train load having increased from 121¼ tons to 126 tons. There was also an improvement in the average speed, as the net ton-miles per engine hour were 431 as compared with 419.

Notes and Memoranda.

It is noteworthy that among the equipment recently put into commission in the diamond fields of South-West Africa, there are electric locomotives of as great a weight as 72 tons, running on rails with a gauge of 24in.

In view of the value of the work so far accomplished by the B.E.S.A., and the inadequacy of its financial resources, the Institution of Electrical Engineers has this year made a grant of £1000 to the British Engineering Standards Association.

A Breguet biplane flying under wireless control without a pilot has been tested successfully at Istres. In the last few days it has made several pilotless flights and has taken off and landed eleven times without mishap. The French Government Air Official Trials Committee has decided to accept the device and the machine will be brought to Paris shortly.

For the purpose of moving two large steel oil storage tanks through a distance of about 1000ft., a special canal was recently made in California. The tanks measured 86ft. in diameter by 30ft. high, and weighed over 100 tons each. They were moved in an artificial channel, containing only 20in. of water. The note in *Engineering News-Record*, from which we cull this information, does not indicate the means of propelling the tanks through the water.

Heating by electricity has enormously grown in favour in Switzerland, and recent statistics furnish interesting details as to the progress made in this direction. At the end of 1913 there were 91,000 different installations in existence for heating purposes. Thirteen years later there were as many as 1,040,000 appliances used for domestic purposes. Included in this figure were 100,000 electric stoves and hot plates, 150,000 electric tea and coffee pots, and 500,000 electric irons (65 for every 100 families). In addition there were 100,000 radiators, 40,000 electric boilers, electric foot-warmers, electric compresses, and many other useful inventions.

Professor H. T. Barnes, of McGill University, in the course of a lecture delivered before the Toronto branch of the Engineering Institute on October 20th on "Ice Engineering," outlined a plan by which he claimed that the St. Lawrence River might be kept free of ice and thus opened to navigation throughout the winter. The waters of Lake Ontario, he said, lost 50 per cent. of their heat in passing through the Thousand Islands, owing to the many bays and rapids. He maintained that the construction of fills or auxiliary channels through the Thousand Islands to speed the passage of the water, would render freezing impossible and leave the river open.

The new Klingenburg electric power station, recently placed in operation by the Berlin Municipal Electricity Company, has an initial capacity of more than 300,000 kVA. The plant now in operation comprises three main turbines and generators, each of 88,000-kVA capacity, and three preheated 12,500-kVA turbine sets generating current at 6000 volts. Steam is supplied by a battery of sixteen boilers, each having a heating surface of 18,837 square feet. The boilers, which are all fired by pulverised fuel, work at a pressure of 514 lb. per square inch and generate steam at a temperature of 425 deg. Cent. In order to save time in fabrication, the sixteen boilers were constructed by eight different German concerns.

An electrical tube, which operates on approximately one billionth of an ampère of electrical current, is being demonstrated in the show window of an automobile firm in New York. The tube, which is the invention of D. D. Knowles, research engineer of the Westinghouse Electric Company, is so sensitive that it will respond to the shadow of a hand passing over it. A spot is indicated on the window, and anyone from the outside passing his hand over this spot sets up an immediate reaction in the tube, sufficient to put the starting motor of a motor car into operation, and the car starts and goes forward and backward. It continues in operation until the shadow of a hand is again passed over the spot on the window, which automatically shuts off the electric energy.

Electricity was first introduced into mines as an obvious solution of the problem of driving in a confined space machinery for coal cutting, for haulage, and for working pumps. Safety of life is the dominant factor, and every modern development of underground gear is in this direction. In an article in the *Electrical Times* of November 3rd, Professor W. M. Thornton lays stress on the improved lighting of the underground roads and on the elimination of the horse as a means of traction. The oil lamp is useful as a gas detector in mines, but it will inevitably give place to portable electric lighting sets. The spark occurring when an electric lighting circuit is broken may cause an explosion. Professor Thornton has shown, however, that it is possible to go on breaking a 500-frequency, 200-volt lighting circuit carrying 20 ampères in an inflammable mixture of coal gas and air for hours without anything happening. With 200 volts direct current, ignition followed at once when the current was 1 ampère. This suggests the possibility of using higher frequencies for lighting in mines.

According to the Dominion Bureau of Statistics, the production of electrical apparatus and supplies in Canada during 1926 amounted in value to 69,767,308 dollars. This output was the greatest recorded for this industry and exceeded by 16 per cent. the previous high record of 60,158,837 dollars established in 1925. The electrical apparatus industry has shown constant expansion over the last five years in capital employed, number of employees, and in the value of production. In 1922 the number of plants was 101 and they employed a capital of 62,436,282 dollars, while the selling value of products was 41,208,368 dollars. In each year there have been increases, the corresponding figures for 1926 being:—Number of plants, 132; capital employed, 80,323,534 dollars; selling value of products, 69,767,308 dollars. The number of employees has grown from 10,630 in 1922 to 15,246 and the annual pay roll from 12,162,607 dollars to 18,626,500 dollars. Ontario leads in electrical apparatus manufacturing with 98 plants, followed by Quebec with 19; Manitoba, 6; British Columbia, 5; and Alberta, 4.

Miscellanea.

It is proposed to construct a hydro-electric plant of 40,000 horse-power at Indian Falls on the Nipisiguit River, New Brunswick.

There is in process of construction a power transmission line 200 miles in length, between the Ottawa River and Toronto, which will be worked at a pressure of 220 kilovolts.

A new bridge of the Scherzer type was recently opened at Tientsin. It crosses the Haiho near the old bridge, and has a width of 58ft. for traffic against 28ft. on the old bridge. There are special passages for rickshas. There is a free opening for river traffic of 140ft. as against 57ft. in the old bridge. The mobile span is worked by four electric motors of 65 horse-power each.

The Minister of Health and the Minister of Agriculture and Fisheries have appointed a Joint Advisory Committee, with Sir Horace Monro, K.C.B, as chairman, to consider and from time to time report on the position with regard to the pollution of rivers and streams and on any legislative, administrative, or other measures which appear to them to be desirable for reducing such pollution.

It is proposed to establish a saw mill and pulp mill on the Ecstall River, a tributary of the Skeena, near Port Essington, British Columbia. The amount involved in the plans is 1,500,000 dollars. The saw mill capacity will be 50,000ft. daily with a weekly pulp producing capacity of 100 tons from the first unit, with provision for installation of four additional units. Employment will be provided for 100 men, and construction will begin almost immediately.

Evidence of the speed with which cargoes can be handled at Tees wharves was demonstrated recently, when 5500 tons of iron ore were discharged in forty-four hours. The vessel was the Torne, of Sweden, discharging at the Cargo Fleet Ironworks Wharf. Continuous shifts were worked for the discharging of the load, by means of up-to-date transporter cranes at the works. This is claimed to be a record for Tees-side, if not for the country. A near approach to this record occurred on October 8th, when the Abisko discharged 4450 tons of iron ore in thirty-five hours at the same works.

The United States Army is faced with an ammunition problem. It has heavy stocks in hand made during the war, and the peace time needs of the troops have been insufficient to use it up before becoming deteriorated. The age of obsolescence will be reached in three months' time, and as there has been no important new output for ten years there will occur in 1928 a shortage from the period of obsolescence of the old ammunition to the date of new supplies becoming available. The gap or period of shortage is calculated at nine months, and special plans have been prepared to build up a reserve supply for war.

The electrical apparatus industry of Canada has shown constant expansion over the last five years in capital employed, number of employees, and in the value of production. In 1922 the number of plants was 101, and they employed a capital of 62,436,282 dollars, while the selling value of products was 41,208,368 dollars. In each year there have been increases, the corresponding figures for 1926 being:—Number of plants, 132; capital employed, 80,323,534 dollars; selling value of products, 69,767,308 dollars. The number of employees has grown from 10,630 in 1922 to 15,246, and the annual pay roll from 12,162,607 dollars to 18,626,500 dollars.

Vancouver Harbour is to have adequate facilities for handling British Columbia and Alberta coal for bunkering, domestic or export purposes. The new bunkers will be erected at North Vancouver at a cost of 250,000 dollars, and will be completed before the end of this year. The plant will have a deep-sea berth with a maximum depth of 35ft., and will have a loading capacity of 200 tons an hour, with a storage capacity of 45,000 tons. In addition to the main plant, a barge with bunkering capabilities of 250 tons an hour and a load limit of 1000 tons will be operated and will permit of loading at any point in the harbour. The coal terminals will occupy three acres, and the Harbour Board will lease the lands to the Vancouver Coal Terminals, Ltd., which will operate the bunkers as a public utility.

As the result of a national conference of coal producers and distributors, which, it is stated, is to be held in February next, it is thought that the price of household coal next year will be lower than in 1914. A movement is on foot to popularise the use of coal for heating purposes as against the methods of cooking and heating by gas and electricity, and with that end in view, it is believed coalowners will try to reach an agreement with wholesale distributors and retail merchants. At the conference next February coalowners will be represented from Yorkshire, among other areas, and the agreement which it is hoped to secure includes:—(1) Branding of coal according to various grades; (2) fining of retailers who supply a certain brand of coal which on investigation is proved to be inferior to that demanded; (3) appeal to railways to reduce their charges for transportation of coal.

At a recent meeting of the Thames Conservancy, Lord Desborough in the chair, Mr. J. D. Gilbert, chairman of the Parliamentary Committee, reported that for the second time they had been successful in resisting the attempt of the Croydon Corporation to encroach upon the water supplies in the Thames watershed. It had been the settled policy of the Conservancy for many years to fight for the conservation of the water in the Thames watershed for those who lived in the area. Lord Desborough said the preservation of water in this country was getting a very serious matter. Buildings were extending at an enormous rate, and every house now erected used infinitely more water than in the old days, and it would soon be a serious problem to provide adequate water for the population. He held that the right principle was that the water should be stored and not allowed to run to waste, and then supplied for use. The Metropolitan Water Board had set a very good example in the matter of storage, and he hoped the Conservancy would always support the principle that water should first be stored and then supplied in bulk. Otherwise, there would be great trouble.

BLAST FURNACE GAS POWER PLANT

(*For description see page 569*)

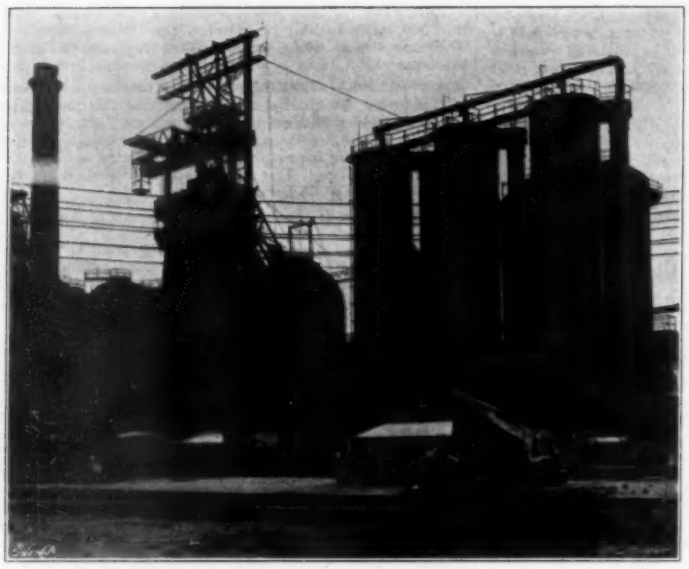


FIG. 1—FURNACE GAS CLEANING PLANT FROM PIG BED SIDE

FIG. 2—VIEW FROM STORE SIDE SHOWING WASHERS AND DRYERS

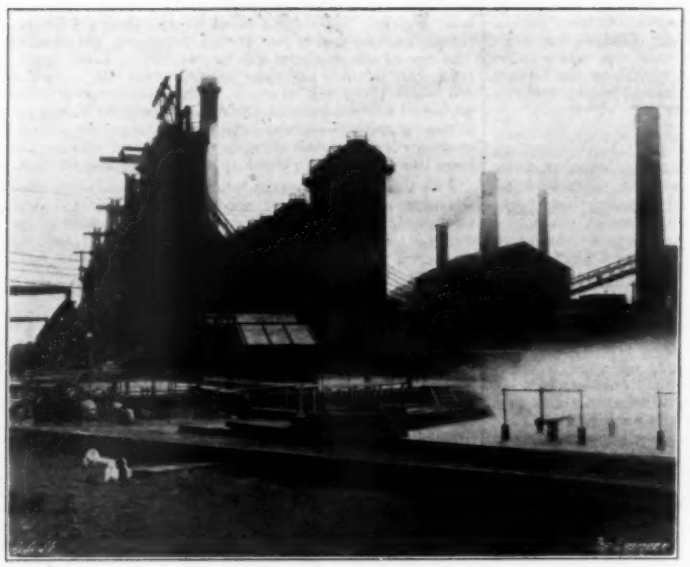


FIG. 3—GENERAL VIEW OF GAS CLEANING PLANT AND FURNACES

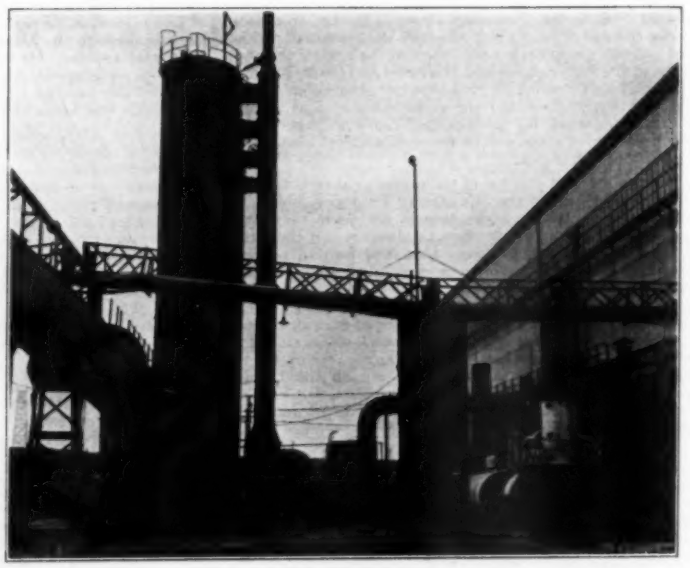


FIG. 4—SECONDARY GAS CLEANING PLANT AND BOILERS

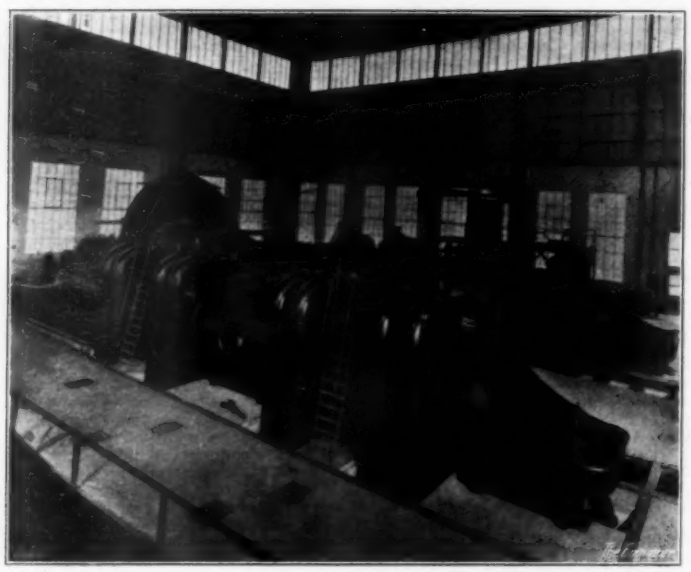


FIG. 5—NO. 1 GAS ENGINE

FIG. 6—NO. 1 GAS ENGINE

The Engineer

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THE ENGINEER.

NOVEMBER 18, 1927.

Motor Cars and Noise.

THAT noise should be reduced as far as possible, not only in vehicles, but in everything else, hardly needs demonstration. Noise means unnecessary waste of nervous energy and reduces the power to work; furthermore, it interferes with the enjoyment of rest when the day's work is over. In many ways the noise of the modern motor vehicle is a very much more serious thing than that of the old horse vehicle which preceded it. Traffic in the country was very small in those days, and in the towns the only continuous traffic was on certain main streets. Many of the side roads were practically quiet. While those engaged in business might have to spend the day in a noisy street, it was, therefore, possible for the large majority to live in comparative quiet during the evening and the night. That is not the case now, for the motor travels far and wide, and even in the remote country the noise it produces has become a serious matter. Furthermore, the actual volume of noise is greater than ever before. A couple of miles away from a road through the country carrying a fair amount of motor traffic a continuous roar can be heard, punctuated every now and then with the raucous exhaust noise of some "sports" motor cycle. Unfortunately, noise is more or less inevitable in the use of machinery, but it should be the endeavour of the designer and user to keep it as small as possible.

Motor vehicle noises may be divided up into those produced by the vehicle itself and those caused by the propelling machinery. It is quite easy to separate these two causes in practice, for we can ascertain what proportion of the total noise arises from the vehicle itself by simply letting it run down a fairly long hill with the engine shut off. In many vehicles the racket produced in this way is rather surprising, being usually caused by loose spring shackles, joints, &c. With the large majority of vehicles, however, the noise produced by the vehicle alone is negligible compared with that generated when the engine is propelling it, and it is usually a great joy on a long run, in even a high-class car, to be able to shut off the engine and "coast." In any case vehicle noise can be reduced by careful fitting and maintenance of parts. The real trouble lies in the propelling machinery, *i.e.*, the engine and transmission gear. Here we have two essential problems to consider, one the very high speed at which the machinery runs, and the other the various noises which are only due to defects in construction or maintenance. The last are naturally the easiest to deal with. Under this head we may take defective silencers, beloved by certain drivers of "sports" cars and cycles, noises produced by loose engine bearings, noisy gear wheels, &c. These can all be silenced in various ways, and there is no doubt that, on the whole, there is a general improvement. Yet it is inevitable that machinery run at very high speed should be more or less noisy. The noise may not be as objectionable as some other noises, being in a well-made machine a smooth hum rather than a jangle; but still it is there. Anyone who has been in the test house of a motor factory where absolutely new engines, with no slack in any bearings, are being run will realise that there is a very great deal of noise; in fact one has to shout to be heard. If the engine speed could be reduced there is no doubt that the noise could be lessened. It seems possible that a good deal could be done in this direction, but unfortunately the Government system of taxation of private cars is a direct encouragement to high engine speed and therefore noise. Under this system the tax a car pays is regulated solely by the size of the cylinders. The size of cylinder required for a given power is inversely as the revolutions, and therefore there is every incentive to use the highest engine speed practicable. To run successfully at high speed, however, the bearings have to be large and the crank shaft and crank case very heavy to take inertia stresses. Hence we get an engine which is not as light per horse-power as one with larger cylinders running somewhat slower and whose only merit is that it pays a small tax in proportion to the power it actually develops. Naturally, the more moderate speed engine would be quieter. In many other countries taxation is on a more reasonable basis, and accordingly we find that the American manufacturer adopts larger cylinders and generally more moderate revolutions. It is largely for this reason that the Americans export very many more cars than we do. Their manufacturers are well aware of the enormous handicap our manufacturers are under from this form of taxation. Motor lorries, public service vehicles, and motor cycles are taxed on either weight or passengers carried, which is a far more equitable and satisfactory basis, and therefore the two former as a rule have more moderate-speed engines; but even here the influence of the motor car is felt, and in motor cycles the classification by cylinder capacity for racing purposes has influenced the design. Another feature of modern practice which conduces to high engine speed is the demand from the public for very great hill climbing power on top gear. It has resulted from the fact that so far no ordinary gear-box which is really quiet on the lower gears has been produced. There is little doubt, however, that many cars would be very much improved by being geared up so as to reduce the engine revolutions on the top gear, more use being made, of course, of the lower gears. That plan could be carried still further if one of the lower gears could be made really quiet, and it is noticeable that a recent American car is fitted with a four-speed gear-box in which the third speed is made through internal gears which are said to give a drive as silent as the direct top gear. Apart from reducing engine speed there is no doubt room for a great deal of improvement. Silencing of the exhaust, as a rule, is now pretty good, especially in the case of engines with six or more cylinders, which will probably soon become general practice for four-wheeled vehicles. Certain "sports" cars and a good many motor cycles leave very much to be desired here. With regard to other noises, heavy vehicles use their change-speed gears a good deal and they often need much improvement. Apart from some radical change such as internal gears, we can only hope here for improvement in workmanship and detail design. Most other noises are also mainly matters of workmanship.

A very important point with regard to noise is the question of control. At present the execution of the law in this respect is in a most unsatisfactory state. It is largely left to the magistrates and police of each district to judge what is excessive noise and what is not. With the best intentions in the world it is therefore impossible that anything like a uniform standard should be worked to all over the country and a motor driver may be summoned for making a noise in one part of the country while others making far more are left

alone in other parts. The natural result is that it is practically impossible to put any real check on noise, while the few prosecutions which take place simply cause annoyance. How standardisation of noise could be carried out it is rather difficult to say. On the one hand, everyone who uses the roads knows perfectly well that there are machines on it which make a perfectly unnecessary and deafening racket, and, on the other, there are cases of convictions for noise in which the machines are of standard types in every respect as supplied by the makers and of types in general use. Between extremes, however, there is a very large margin, and it is obviously undesirable to establish suddenly any standard of silence which would at once render any large proportion of the vehicles on the road unusable. In the case of new machines it might be a very great help if a sample could be submitted to some central authority and passed, and if it were accepted all over the country that any machine exactly similar was satisfactory. Buyers of machines not so passed would have the onus of proof of silence on them in case of prosecution, and in a very short time probably all makers would get such certificates in their own interest. That course might soon establish a standard of silence which could be universally worked to. But whatever the means adopted, it is extremely desirable that something should be done to check at once the use of extremely noisy cars and motor cycles, often driven by the younger generation, who seem to think that the noisier the machine the more of a "sporting" character it has, and at the same time to ensure that other machines which are up to the standard of silence generally employed are not prosecuted by local authorities who are without guidance in the performance of their duties.

Power Alcohol Again.

THERE is no nation under the sun which has not within its own borders the means of providing itself with a liquid fuel suitable for use in internal combustion engines. Wherever the sun shines and vegetation flourishes, there the production of alcohol is possible. If any country, possessing neither oil nor coal, were completely deprived of supplies of those fuels from other lands, it could still generate power from the resources which Nature has given it in the form of vegetable produce. All other materials from which heat is derived by combustion are exhaustible. Our coalfields and oil wells must, in time, be worked out; but alcohol we can always have as long as the sun shines and plants grow. It has therefore, since nations began to think seriously about such things, continuously attracted the attention of fuel technologists, chemists, and economists. Never a year passes without a reinvestigation of its perennial problems; hardly a year goes by without the publication of a report upon the scientific and economic position of power alcohol. The solution of those problems holds enormous possibilities. For the great proportion of its liquid fuel supplies the world is dependent upon oil wells. Estimates of the life of those wells may be far too low; estimates of the rate of consumption may be far too high. But the fact remains that in the course of time, probably a few generations at most, all the wells will have run dry. Coal, perchance, will long outlive oil, but even it, as a source of liquid fuel, must sooner or later be exhausted. Then, in that still far distant time, if heat or power is not derived from some hitherto untapped source, the economic position will have changed and alcohol will have its day.

If there were no other reasons for the study of power alcohol than the cessation of the world supply of competitive liquid fuels, then efforts would be wasted on those investigations. If every nation had its own oil wells, then the problems of the artificial production of a liquid fuel would be left to merely inquisitive people. It is because liquid fuel has become an essential commodity and because it occurs naturally, in workable quantities, in but a small number of areas of the earth's crust, that the question is one of real economic importance. In this country, it has not, indeed, been neglected, but of late years the production of liquid fuels from coal has almost displaced it; in France, in Germany, it never ceases to receive attention, and in both countries production on a useful scale goes on continuously. In India the matter has been carefully examined, and in Australia, where success would mean so much, it is never forgotten. We are reminded of that fact by an admirable bulletin which has recently been issued by the Australian Council for Scientific and Industrial Research. Two earlier publications, Nos. 6 and 20, which are now out of print, excited a great deal of interest in their time. It is impossible to doubt that the present monograph, for which Mr. G. A. Cook, M.Sc., is responsible, will be received with equal interest. There is a peculiar fascination about the problems of power alcohol, possibly because they seem to be always upon the point of solution, and there have appeared few, if any, reports which were not readable; but Mr. Cook has handled the whole subject with such breadth and knowledge, and with such a clear logical balancing of the conflicting elements, that we have found his essay more than commonly attractive. Australia is almost entirely dependent upon foreign countries for her supply of liquid fuels. She imports petrol and similar light spirits to the value of about six and one-half million pounds each year, and the number of motor vehicles in the Commonwealth is increasing at the rate of about fifty thousand per annum. She has coal, but despite a great deal of expenditure, oil has never been tapped, and geological opinion inclines to the view that it does not exist in commercial quantities. Unless, then, she recovers oil from coal, she must remain dependent upon imported supplies or produce power alcohol. In these respects she is not very different from the Mother Country, but there is this important difference, that whereas Great Britain has not the space to spare for the growth of crops for alcohol production in great quantities, there is not only abundant space in Australia, but climatic conditions which favour rapid growth and the cultivation of vegetation which would not grow here. She has, therefore, particular reasons for studying the problems with exceptional care and conditions which may turn the scale in economic considerations. "In certain parts of Australia," says Mr. Cook, "where conditions are favourable for the supply of raw materials at a comparatively low cost, the commercial production of power alcohol by fermentation, and at a price which would enable it to compete with petrol, appears to be feasible, and, in fact, a distillery has been opened in Queensland where substantial quantities of alcohol are now being produced." Economic success turns upon a hair. "Should the price of petrol rise by but a small amount, the possibilities of the commercial production of large quantities of power alcohol in Australia would be considerably improved." The distillery to which Mr. Cook refers is, no doubt, that run in conjunction with the sugar mill at Plane Creek. It uses molasses with cassava and arrowroot, and has an estimated output of one million gallons per annum. Assuming that, in this case, the raw materials may be considered as cost free, then the alcohol costs 7·6d. to produce; 9d. more must be added for "casing" and distribution, making a total of 16·6d. per gallon. The retailers would probably require another 3d., thus bringing the price up to nearly 1s. 8d. That figure would be prohibitive in this country, but leaves in Australia a margin of a few pence when compared with petrol, which costs there about 2s. per gallon. As, moreover, Australia can grow more sugar than she needs, the prospects of an extension of the production are a little less remote than in most power alcohol schemes. But it is not certain that the most economical way of using cane sugar by-products is to convert them into alcohol, and, in any case, if crops are grown specially for alcohol production, the price of the commodity rises rapidly. In Australia attention is therefore being directed to the distillation of cellulosic materials—wood waste and so on—but so far without much indication of an economic solution. There are other means of producing alcohol—by the conversion of acetylene, and the hydrogenation of carbon monoxide—but even if they are proved to be successful on economic grounds, it is not certain that they would accommodate themselves to Australian conditions.

We have suggested that the attraction which the problem of power alcohol production possesses resides in the fact that we always seem to be on the edge of success. That feeling remains with us when we turn to Mr. Cook's conclusions. Reviewing his admirable survey, he seems to be alternately upon the point of saying it cannot be an economic success and it can be. The fermentation process is too expensive, because the raw materials are too costly; yet there are places in Australia where it might compete with petrol. Where tubers are available, alcohol holds out some prospects; yet such raw materials are very bulky and transport is expensive. The cellulosic method is of greater potential importance; yet the method is in an undeveloped state. Synthetic methods have not much hope in Australia, and the catalytic method, important as it appears to be, has not yet gone far enough to permit the expression of a definite opinion. The uncertainty shown by the sentences which we have put in opposition to one another are fully justified by the facts. They show, as we have said, that success is trembling in the balance. But a little more in its favour and power alcohol would become an important addition to the fuel supplies of the world.

Literature.

Handbook of Ore Dressing. By ARTHUR F. TAGGART. New York: John Wiley and Sons, Inc. London: Chapman and Hall, Ltd. 1927. Price 50s.

IT may fairly be claimed that the dressing of minerals must rank as one of the earliest of the arts devised by man, seeing that such primitive applications of it as gold washing must have been coeval with or possibly even earlier than actual mining operations. In spite of the enormous antiquity of this art, progress in it has been comparatively slow up to quite recent times, and the advance within the last half century or so far outweighs all that had been done up to that time. This state of affairs is perhaps a necessary consequence of the fact that with the exhaustion of the richer mineral deposits and to keep pace with the ever-growing requirements of civilised existence, it has been found necessary to exploit deposits of a grade so low that they would have been considered worthless a few decades ago, and the economic exploitation of these low-grade deposits has been rendered possible only by the vast improvement in the principles and practice of dressing. A necessary consequence of this rapid evolution of the dressing of minerals has naturally been such a state of activity in the art that it is hardly too much to say that every text-book on the subject becomes to some extent out of date even whilst it is passing through the press, so that the need for new works on the subject is constantly urgent.

In spite therefore of the large number of works devoted to this subject, Professor Taggart's new book fills a gap in the literature of the subject, and will be welcomed by the very large circle of those interested in his subject. His title is perhaps an unfortunate one; a bulky volume of nearly 1700 pages can hardly be described as a handbook, and whilst the title suggests that the work is restricted to the dressing of metalliferous minerals, that is far from being the case, seeing that coal cleaning receives quite full consideration. It need hardly be said that to describe coal as an "ore" is a gross misuse of language, and in spite of the fact that much American technical literature is becoming distinctly slipshod, it may be doubted whether any American writer would take upon himself to justify such a use of the word "ore."

The book contains much matter of the highest importance. It may be said at once that it is probably right both from the scientific and from the technical point of view to deal with the dressing of ores, coal and other non-metallic minerals in one work, because the principles used in all cases are identical and the appliances are practically so, except for certain minor modifications made necessary by variations in the relative proportions of the valuable ingredients and of those which it is desired to get rid of. Treated in this way, the subject becomes much more readily intelligible, and it is particularly useful for men practising one or other branch of the art of dressing to have their attention called to what is being done in the sister branch.

Professor Taggart has covered the ground in the widest possible manner, including in his book everything between the hydraulic sluicing of gold and dry coal cleaning. He even goes beyond the limits that are usually assigned to the dressing of minerals, inasmuch as he includes a short chapter on hydrometallurgy, which most authorities look upon as outside the province of the dresser; perhaps the author would advance by way of excuse to the introduction of this section that "it is only a little one," and it is certainly of no use to anybody. The information given in it is so sketchy that it is equally useless to the practical man and to the student, and would, in fact, have been far better omitted. It will be gathered, however, that no fault could be found with the book on the score of incompleteness, but that every branch of the subject receives consideration. The work is, in fact, a monumental storehouse of information, and therefore forms a reference book of the highest value to all engaged in the practice of the art of dressing. It differs from most other works on this subject in that it is of a thoroughly practical character whilst theoretical considerations are either passed over altogether or treated very briefly. Furthermore, it cannot be said that the author's theory is everywhere sound. For example, in his discussion of the fall of bodies in a fluid, he states that "in all cases acceleration decreases rapidly and the body quickly attains a uniform terminal velocity." Now authorities are practically unanimous in declaring that a body falling under such conditions can only attain a uniform falling velocity after an infinite period of time. It would have been quite correct to state that a body falling under these conditions rapidly attains a practically uniform velocity, but it

is incorrect to state that the velocity is truly uniform.

In the same way the author's theory of jigging is very imperfectly worked out, and he appears to be quite unaware of the work on the principles of jigging that has been done by Swedish investigators. In fact, it may not unfairly be said that this book is a record—and incidentally a very good record—of American dressing practice, but that the author's knowledge of what is done in the matter outside America is exceedingly small and his statements on the subject often incorrect. Perhaps one example will suffice for British users: Under the heading of the "Treatment of Tin Ores," he describes the East Pool Mill, the position of which he gives as "Cornwall, Wales"! It is scarcely necessary to add that his information as to the treatment actually employed is not much better than his knowledge of its geographical situation. Again, his description of screens is, broadly speaking, very complete, but the only gyratory screen of which he seems to have any knowlenge is the Coxe screen, and the only form of screen in which the bars have independent motion, or, as he terms it, "moving bar grizzly," is the Briart screen. He seems to be unaware of the numerous modifications of both types that have been introduced in Europe.

Apart from the above criticisms, Professor Taggart's work deserves nothing but praise. He has most painstakingly accumulated pages upon pages of data taken from actual mill practice and has condensed the data from these and from numberless manufacturers' catalogues into tables which will be found to be of the greatest use to all engaged in designing dressing plant. In this connection, however, it is to be regretted that his illustrations are absurdly and inadequately small, whilst scales are throughout conspicuous by their absence. His drawing of a stamp mill, for example, is only just over 1in. in height, and would certainly not convey anything like a correct impression to anyone who had never seen a stamp mill; whilst for one who knows what a stamp mill is like, it is absolutely useless. Drawings of machinery such as this should either be large enough to show all the essential details of construction or be left out altogether; such thumb-nail sketches are worse than useless. It may also be questioned whether the last 400 pages of his book, consisting of a number of sections upon Mathematics, ranging from arithmetic to calculus, on Physics, Chemistry, Theoretical and Applied Mechanics, are likely to be of the least use. Surely a person who needs instruction in elementary algebra is not likely to be entrusted with the design of an important dressing plant, nor would anyone ignorant of the subject seek his instruction in a work on Ore Dressing. All this matter, much of it highly elementary, had far better have been omitted, thus reducing the book to more convenient dimensions. A work on Ore Dressing is not supposed to be a compendium of all the sciences, and had infinitely better be restricted to the particular subject which it treats, especially when that subject is so well and so thoroughly dealt with as it is in Professor Taggart's book.

Gases, Dust and Heat in Mines. By K. Neville Moss, O.B.E., M.Sc., F.G.S., Assoc. M. Inst. C.E. London: Charles Griffin and Co., Ltd. 1927. Price 12s. 6d.

This book of Professor Moss not only contains in itself much interesting material, but has a special interest as showing the trend of modern thought, in which the effect of the occupation upon the worker is studied from the point of view of its effect upon his health and comfort; it illustrates in effect the modern tendency to study the worker not so much as a worker, but as a human being. Professor Moss has devoted very much attention to the study of the physiology of the miner, and the present book is a summary of his work up to date.

He opens with a detailed discussion of mine air, of the various impurities which may occur and of their effects upon the worker; in the same way the effects of oxygen deficiency are described. There is, naturally, a chapter on fire-damp and another upon carbon monoxide, the two really dangerous gases which the coal miner may meet with, the former dangerous on account of its liability to explosion, and the latter the chief source of danger to life after an explosion has taken place. The former danger has long been known and dreaded in coal mines; the latter has only been discovered comparatively recently, the knowledge of its deadly properties being but little over thirty years old. Another chapter deals with the still more recent discovery of the danger to the health of the miner that may be caused by certain dusts, and the physiological effect of these is discussed at length.

The second portion of the book considers the mine atmosphere from the physical point of view, the effects of pressure and temperature being specifically investigated; there is also an interesting chapter on hygrometry and the importance of the determination of the amount of moisture in the air is well pointed out. Anemometry is briefly considered, this being perhaps the least satisfactory portion of the book, and one which should be expanded in a future edition. The third section deals with the physiological effects of high temperatures in mine air, the methods of counteracting these effects, and the methods of reducing the temperature and the moisture contents when necessary. There is lastly a short chapter on ankylostomiasis, which appears to be out of keeping with the general purpose of the book; the only reason that can be given for its inclusion here is that under certain conditions this disease is more likely to be prevalent in hot and moist mines than in mines in which the opposite conditions prevail.

A good deal of the book, especially of the latter part of it, is a summary of the original work done by Professor Moss himself. The main portion of the book is, however, merely a compilation of previously existing knowledge; some of this was, however, widely scattered through papers in a variety of different "Transactions" and *Journals* and often not very readily accessible to mining engineers, and Professor Moss has rendered a distinct service to the profession by bringing it all together in a convenient and readable form. In order to make his work complete he has naturally been compelled to include a good deal of what was well known and elementary, as well as the results of less widely known recent investigations, but he has succeeded in doing this in such a way as to present to the reader a clear picture of present-day views upon the various subjects under discussion.

The importance to the mining engineer of the subjects here treated is quite indisputable, and he is fortunate in having found so capable and clear an exponent as Professor Moss. The book is appropriately enough dedicated to Dr. Haldane, with the results of whose invaluable investigations this work is so largely concerned. No one has done more than Dr. Haldane for the health and well-being of the miner, and it is fortunate that the results of his work are here made accessible to the mining industry by one who, through his close and intimate association with Dr. Haldane, is particularly well qualified for this important task.

The A.C. Commutator Motor. By C. W. Olliver. London: Chapman and Hall, Ltd. Price 21s.

Although the A.C. commutator motor is not widely employed in this country, the rapidly increasing use of alternating current will probably give rise to a greater demand for this type of machine in the future. For many purposes squirrel-cage and slip-ring induction motors leave little to be desired, but when efficient speed regulation is needed, the A.C. commutator motor should be considered. For some reason, there is a strong prejudice against this form of machine, and it is not unusual in this country when fine speed regulation is required to convert alternating current into direct current, a scheme which is costly and inefficient. In the present volume the author endeavours to break down this prejudice and to show that A.C. commutator motors are quite useful machines.

The book is divided broadly into two main parts, the first dealing with the analytical side of the subject and the second part with the practical applications of A.C. commutator motors. The first part will probably appeal more particularly to students and others who wish to gain an insight into the theory of these machines, whilst the second part will interest practical engineers, who have to grapple with electrical power problems. Perhaps one of the reasons why A.C. commutator motors are not popular among practical men is that from time to time a good deal of highly technical literature has been published relating to them, and that as a result these motors have acquired the reputation of being complicated and difficult to understand. The present volume, however, is written on rather more simple lines than some books and papers on the subject, and the second part of it, at any rate, should not present much difficulty to the average practical engineer with a fair general knowledge of alternating currents. Apart altogether from the ability of A.C. commutator motors to run economically at different speeds, it also has the advantage of working with a high power factor. It is, nevertheless, a curious fact that while various kinds of devices are employed for raising the power factor, such as synchronous condensers, static condensers, and phase advancers, the possibility of attaining the same result by installing commutators is rarely considered. It may be argued that A.C. commutator motors are more expensive than induction motors, but it must not be forgotten that condensers and phase advancers also involve additional expense. Where speed regulation is required, and the power factor problem also demands attention, the A.C. motor and its combinations ought not to be overlooked, and in view of the present tendency to replace direct-current distribution systems by alternating current systems, the present volume has come at an opportune time.

The fundamental difficulty in the design of A.C. commutator motors lies in the fact that the main alternating flux acts upon the short-circuited coils in the armature. The method of combating this is to introduce a neutralising flux, and as that involves the balancing of two large quantities, it appears difficult to obtain and maintain sufficient accuracy to ensure successful operation. The author shows, however, that the desired result can be obtained by the use of a small interpole in a stator tooth excited to give the correct phase and magnitude of flux density, and that exact counterbalancing of the main alternating flux is not essential. The fear of unsatisfactory commutation is so deeply ingrained in the mind of the motor user, that the author has deemed it desirable to deal with this important matter at considerable length, and to show that properly designed A.C. commutator motors are quite satisfactory in this respect.

In the second part of the volume, which is less theoretical than the first part, the author describes various types of A.C. commutator motors and their applications. The book covers three-phase and single-phase motors, and a good deal of space is devoted to single-phase electric traction.

SHORT NOTICES.

The Profession of Chemistry. By Richard B. Pilcher, O.B.E., Registrar and Secretary, the Institute of Chemistry of Great Britain and Ireland, 30, Russell-square, W.C. 1. Just after the conclusion of the war, when the influence which the science and practice of chemistry had upon that struggle was constantly before the public eye, and when young men were crowding into the profession, Mr. Richard Pilcher wrote a little book which was published by Constable and Co. When it became evident that a new edition of the work would be necessary, Mr. Pilcher generously surrendered his copyright to the Institute to which he has devoted his life and energies. The present small volume, issued by the Institute, is the result. To say that it is altogether admirable is the easiest way to deal with it, and, moreover, happens to be strictly true. The author's object is not only to guide would-be chemists, but to give the general public some idea of all that is now meant by that comprehensive term. He deals with education, preliminary and professional; with the prospects and conditions of practice; with professional organisations and procedure; with chemistry and the State and with industrial chemistry. He writes in an easy style with complete knowledge of his subject, and with sound common sense. We cannot do better than recommend all young men who are thinking of following the profession, and all parents and guardians who are thinking of putting young men into it, to read—no difficult matter—Mr. Pilcher's little book.

Hydraulics. By E. H. Lewitt. London: Sir Isaac Pitman and Sons, Ltd. Price 10s. 6d. net. *Hydraulics.* By E. W. Schoder and F. M. Dawson. London and New York: McGraw-Hill Publishing Company. Price 17s. 6d. net. *Hydraulics.* By H. W. King and C. O. Wisler. New York: John Wiley and Sons.—These three volumes are alike in being more or less elementary text-books, but in their treatment of the subject to which they are in common devoted, they differ to a considerable degree. Messrs. Schoder and Dawson's book is distinguished by the amount of attention which it pays to the flow of water and other fluids in pipes and open channels and over weirs. Messrs. King and Wisler's book is distinguished by nothing in particular except it be its brevity in its treatment of hydraulic turbines and a curious attempt to "prove" Newton's second law of motion by deducing it from Bernoulli's theory. Mr. Lewitt's book appeals to us as a well-balanced treatment of the subject in which sufficient but not more than sufficient attention is given to the practical design of turbines and other hydraulic machines.

The Essentials of Transformer Practice. By Emerson G. Reid. London: Chapman and Hall, Ltd. Price 21s.—While there is no scarcity of books on transformers, this second edition of Mr. Reid's book is far more interesting and instructive than many we have seen, and it should go a long way towards meeting the requirements of those who desire to gain an insight into transformer design, construction and operation. The scope of the book has now been enlarged by the addition of something like fifty per cent. of new material, which covers, among other things, an approximate method of transformer design, the physical and chemical properties of insulating oil, voltage transformers, the theory of the current transformer, the phase angle of the current transformer, reactors, electrostatic stresses under operating conditions, and loading transformers on a temperature basis. The book has the merit of being written on simple and straightforward lines, and unlike some books on the subject, it does not contain innumerable complicated vector diagrams and a lot of mathematics. In short, the volume has been written for practical men.

BOOKS RECEIVED.

Elementary Building Science. By A. Everett. London: The Oxford University Press, Falcon-square, E.C. 1. Price 7s. 6d. net.

Vertical Shaft Sinking. By E. O. Forster Brown. London: Ernest Benn, Ltd., 154, Fleet-street, E.C. 4. Price 52s. 6d. net.

Concrete Building Construction. By T. Crane. Edited by T. Nolan. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 30s. net.

The Higher Coal-Tar Hydrocarbons. By A. E. Everest, D.Sc., &c. London: Longmans, Green and Co., Ltd., 39, Paternoster-row, E.C. 4. Price 18s. net.

The Principles of Planning Buildings. Fourth Edition. By P. L. Marks, L.R.I.B.A. London: B. T. Batsford, Ltd., 94, High Holborn, W.C. 1. Price 21s. net.

Examples in the Strength and Elasticity of Materials. By G. W. Bird, B.Sc., &c. London: Edward Arnold and Co., 41, Maddox-street, W. 1. Price 10s. 6d. net.

Principles of Radio Communication. Second edition. By J. H. Morecroft. Assisted by A. Pinto and W. A. Curry. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 37s. 6d. net.

Annali dei Lavori Pubblici (già Giornale del Genio Civile) Ministero dei Lavori Pubblici, Consiglio Superiore. 1927. No. V., Agosto. Rome: Provveditorato Generale dello Stato. 1927.

The Public Works, Roads and Transport Exhibition.

No. I.

THE Exhibition which is held in connection and concurrently with the Public Works, Roads and Transport Congress, was opened in the Royal Agricultural Hall, Islington, on Monday last, and closes to-morrow. It is the fourth Exhibition of its kind, and in many respects it is better than any of the three which have gone before it. There were a good many novelties on view and the class of the exhibits was high. From the general tone of the whole Show the visitor gained the impression that, though business was "patchy," on the whole the numerous trades concerned were very fairly well employed; indeed, in several instances we were informed that there was as much work on hand as could be comfortably handled, while some firms owned to being really busy. No doubt, much of the activity is due to the large amount of road and bridge construction work that is being carried out in various parts of the country, and as that appears likely to continue for some time to come, there are good grounds for hoping that not only will the present state of affairs continue, but that business may steadily improve. An outstanding feature was the large number of exhibitors of plastic materials for road surface formation who were showing their products. The varieties of such materials continue to grow in number, and those which do not require heat for their application tend to become more in evidence year by year. Then, again, mechanical aids to road construction—concrete mixers, portable air compressors, pneumatic drills and spades and the like—were much to the fore. The exhibits were not, however, by any means confined to materials and machines for making highways. Many new designs of vehicles for using the roads when made were also on view, and it can be said, in fact, that the whole Exhibition was wonderfully representative of the various interests concerned, and it certainly

FIG. 1—REFUSE COLLECTING WAGON—ELECTRICARS

reflected very considerable credit, not only on those who had organised it, but also on the firms, one and all, who were displaying their products.

In placing before our readers the result of our inspections we shall not make any attempt to classify the various exhibits, nor—of course—to make any comparison betwen those of a similar character, shown by different firms. We shall simply refer, haphazard, to various stands, and if one is mentioned before another, it must not be taken that we suggest that it is superior to any other. There is so much to say that it will be impossible to include all of it in one issue, and much must, perforce, be held over for future publication.

With so much preface, then, we can proceed to give some account of the exhibits, and shall begin our remarks by referring to the stands in the Entrance Hall, which the visitor encounters as he enters. First of all, there is the exhibit of R. A. Lister and Co., Ltd., of Dursley, Glos., whose name will always be thought of in connection with the Dursley-Petersen bicycle, with its curious saddle; with automatic electric lighting sets, and with cream separators. None of those things, of course, had place on the stand this week. Instead, there was a collection of serviceable-looking petrol-driven trucks of various types. There was first of all the "Lister" auto-truck, which has an end-tipping body, with a capacity of 32 cubic feet and a self-opening rear door. A companion vehicle has a swivelling tipping body, having a capacity of 30 cubic feet, which can discharge its load at the rear or at either side. Then there was a fixed platform truck with a 1-ton loading capacity. All these vehicles had a thoroughly handy and workmanlike appearance, and they all, so we understand, can be turned in a radius less than their own length. On this stand, too, were several examples of the small hopper-cooled petrol engines for which the firm has gained for itself a considerable reputation.

Near by was the stand of the François Cementation Company, Ltd., of Doncaster, where there was a cleverely made small-scale model of a pit shaft, showing the François method of pit-sinking through water-bearing measures by cementation and reinforced concrete lining. A novel application of the process of cementation is a new type of pile which is formed by filling a cavity with gravel and injecting it with cement, so that the pile thus formed becomes an integral part of the ground around it. Some examples of asbestos-cement pipes, manufactured by Asbestos-Cement Pipes, Ltd., of 1–2, Gracechurch-lane, E.C. 6, were also shown on this stand. These pipes are claimed to be both cheaper and lighter than cast iron, and yet to be capable of withstanding heavy pressures.

Electricars, Ltd., of Birmingham, had on view examples of serviceable electric battery vehicles. There was a 30-cwt. low-loading lorry chassis for general purposes. It has a pressed sheet frame, steering front axle and worm wheel drive, and it has a weight, for licencing purposes, of 24¼ cwt., the tax being £6 per annum. A similar chassis was furnished with an all-steel, end-tipping, refuse collection body—Fig. 1. The turning radius of these vehicles is 13ft., and they are designed to travel at 10 miles per hour on the level with full load. With their standard battery, they can, so we gather, travel about 30 miles, with average half load, per charge. The loading height with a flat body is 2ft. 3in., and with a 4½ cubic yard end-tipping body 4ft. 9in.

Denholm Contractors' Machinery Company, Ltd., of Astor House, Aldwych, London, W.C. 2, had as its most imposing exhibit the half-yard excavator which is illustrated in Fig. 2 above. This machine is intended to cover the field of excavating in its many branches in cases in which a larger and heavier machine cannot be considered on account of its size and weight, and of transport problems. It is capable, so we are informed, of digging and loading as much as 220 cubic yards of earth per day with the employment of only one operator. It may be equipped quickly on the scene of operations to dig trenches or to excavate and grade roads. It is driven by a four-cylinder petrol engine and is mounted on full-length caterpillar tracks on which it moves under its own power, and it is so compact in dimensions and light in weight that it may be transported direct from one job to another on an ordinary lorry trailer without dismantling any single part of the machine.

Other exhibits on this stand included a 2-ton petrol-driven hoist, the engine being a Fordson tractor engine built into the hoist as a unit; and a trench pump, driven by a "Lister" hopper-cooled engine, which can lift 7000 gallons per hour against a head of 15ft., or 5000 gallons per hour against a 50ft. head, and can deal with water, sludge, sewage, &c.

Tangyes Ltd., of Birmingham, had its familiar array of engines, pumps, &c. There were two horizontal engines, one of 39 B.H.P. for heavy fuel oil,

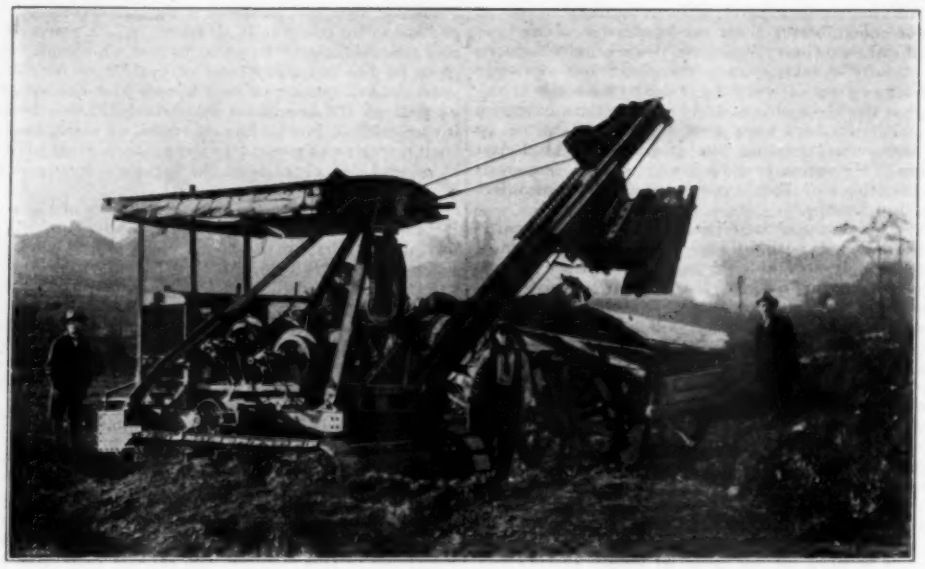


FIG. 2—SELF-PROPELLING CATERPILLAR HALF-YARD EXCAVATOR—DENHOLM

and one of 19 B.H.P. for fuel oil, both of them cold starting, and there were various pumps, both ram and centrifugal, among them a 5in. six-stage turbine pump for high lift work. Then, too, there were examples of lifting tackles and of screw and hydraulic jacks. Altogether a typical "Tangye" exhibit.

W. and J. Glossop, Ltd., of Hipperholme, Halifax, had a prominent exhibit in the Entrance Hall in the form of a large road dressing plant—illustrated in Fig. 3—of the type which has, so we gathered, recently played a leading part in emergency street work in London. It is an automatic tar-spraying machine, which is self-propelling, self-filling, self-heating, and self-spraying, and it, itself, provides superheated steam for all those purposes. The holding capacity of its tar tank is 1000 gallons, and it will heat that volume from cold to "spraying" temperature and will spray it on the road in less than an hour. It sprays a track 2½ yards wide, and it is claimed that the pressure with which it expels the tar is so great that the latter is forced through any dust left on the roadway to the stones beneath and is forced into the interstices of the surface so that there is no "caking" or "peeling off" and that the tar can be applied at any area per gallon desired. It is claimed, too, that the arrangements are such that choked jets are almost impossible. The vehicle has the mobility of a steam wagon. Our illustration is a rear view of the machine

FIG. 3—TAR ROAD-DRESSING MACHINE—GLOSSOP

in the act of spraying, and does not give a true idea of its imposing dimensions.

Parker, Winder and Achurch, Ltd., of Birmingham, had a stand to which one at once gave the epithet "practical." There were all sorts and types of screens and riddles, both flat and rotary, and for operation by hand or by power, including the firm's steel-bladed type and screening panels suitable for incorporation in existing plant. Then there were handy little concrete mixers, both hand and power-driven, including a "Parwinac" 3–4 cubic feet capacity portable mixer, fitted with a "Lister" engine. We also saw

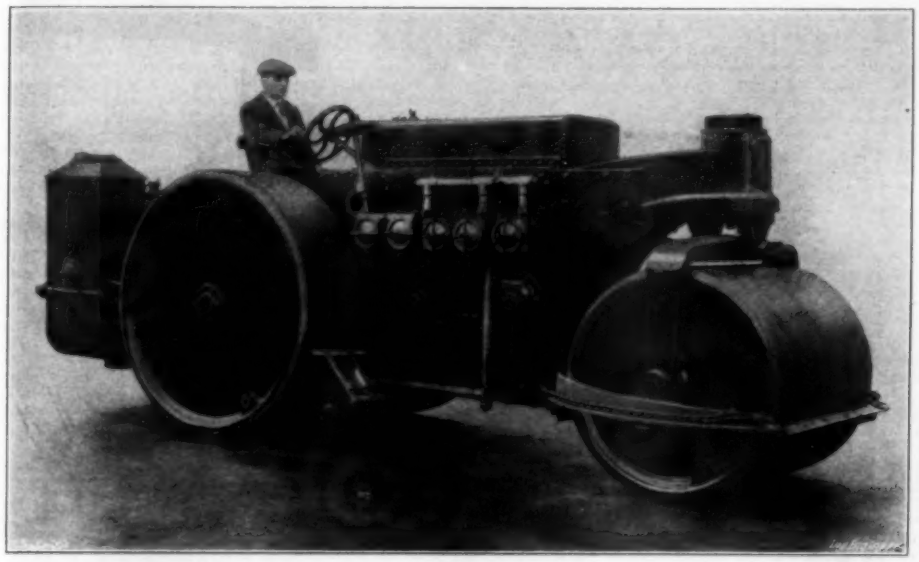


FIG. 4—"GAZOGENE" MOTOR ROLLER—BARFORD AND PERKINS

a post-hole digger of the augur type for hand operation, which seemed to be a useful tool.

Hartley, Sons and Co., of Stoke-on-Trent, had some beautifully made working models of sewage disposal plants, which were shown in operation. Our readers are familiar with the construction of this firm's products in this connection, for we have described them all, so that we need not further refer to the two circular filter bed distributors, which could be seen busily revolving. A short reference may, however, be made of a model showing the "Spiroflow" system of activated sludge treatment. We have described this system, also, and we then explained that by placing baffles in the channels with their faces making an angle with the direction of flow a whirling or spiral motion is given to the liquid which, it is claimed, materially assists in the aeration of the sewage under treatment. In the model shown there were two parallel channels with a special Hartley paddle at one end. Both channels had baffles, and the water used for demonstration purposes contained something which looked very like chopped up tea leaves and which, when the water was stagnant, sank to the bottom of the channel. With the paddle at work and the baffles of both channels set at an angle with the current, these "solids" were taken round and round both channels and the spiral motion imparted to them was very marked. When, however, the baffles of one channel were shifted so that their lengths were parallel to the current, the "solids" in that channel immediately sank to the bottom and were only slowly moved along by the current, whereas the "solids" in the other channel continued their whirling way. It was one of the most convincing models of its kind that we have seen.

Coming to the Main Hall, it is somewhat hard to know exactly where to begin, for there is such a multiplicity of starting points, so that, now, our selection must, indeed, be haphazard. There was, however, an outstanding novelty shown by Barford and Perkins, of Peterborough—a novelty, that is to say, so far as this particular Exhibition is concerned, though machines of a kindred type have been operating successfully on the Continent for some time. It is what the firm terms its "Gazogene" motor roller, and it operates on producer gas for which the fuel employed is wood. A view of this interesting machine is given in Fig. 4 above. The firm has for some years now been watching the performance of the various suction gas producer plants which have been placed on the market, and it has waited before adopting one until a "Gazogene" had been successfully used for a term of years. It at length decided to adopt the Beliet-Imbert type, and has combined it with its own three-wheel design of heavy motor roller. The "Gazogene" producer comprises a funnel-shaped furnace or generator fitted into an air-tight container forming an ashpan surmounted by a hopper containing the fuel. All three parts are of steel plate, the steel lining of the furnace being cooled by the incoming air, so that no fire-clay or fire-brick lining is necessary. The furnace is surrounded in the upper portion by a circular air tube welded to the body of the generator, and embodying eight nozzles directed towards the centre of the apparatus. Four of these nozzles have their axes raised above the plane of the air tube for the purpose of extending the zone of wood combustion. It is through these nozzles that, under the influence of the suction of the engine, the air for combustion is drawn into the furnace. The wood and the embers are held in the zone of the air jets by a grate and a cone adjoining it. The ashpan in which the furnace is fitted has inspection doors for extracting the ashes and the charcoal which have fallen into it, and also for cleaning the grate. At the side of the ashpan is an outlet for the gas, which leads to the purifiers and the engine. The fuel hopper is rectangular in shape. At the top is a filling door and at the bottom an inspection door, through which, when the "Gazogene" is empty of fuel, access is given to the inside of the furnace for inspecting the nozzles. All the doors on the "Gazogene" have air-tight fastenings, and the filling door is secured by a laminated spring fastener which acts as a safety valve.

On leaving the "Gazogene" the gas passes through the purifiers, in which it is cooled and the dust and tar removed from it. There are five similar purifiers arranged in series at right angles to the centre line of the roller. Each purifier is a case of sheet metal, cylindrical in shape, and containing a number of perforated plates through which the gas passes and on which it deposits impurities that it has carried along with it. These plates are threaded on a central guide rod and are kept at the desired distance from each other by means of collars. The purifier is fitted with quickly detachable covers at both ends to permit of the withdrawal of the central guide rod and plates—complete as a unit—for cleaning purposes. The covers have, of course, gas-tight joints. The water condensed in the purifier may be drawn off by a cock. The action of the purifiers is, the makers explain, quite automatic, and they need no attention, except periodical cleaning and the draining of the water each morning before starting. The principal foreign matter in the gas, as it comes from the furnace, is water vapour, and that is condensed on the perforated plates, which then act as a gas filter, collecting on their surfaces dust and other impurities.

The gas when it leaves the purifiers is quite cool, and it passes direct to a tee-piece on the engine induction system. This tee-piece contains a butterfly valve to control the admission of gas. There is also an opening to the air, also fitted with a butterfly valve to control the supply. The mixture then passes into the engine in the usual manner. There is also, it may be explained, a carburetter for starting on petrol or for emergency use, when, for example, it is desired to move the roller such a short distance that it would not be worth while lighting up the "Gazogene." The engine can, in fact, be switched over on to petrol at any time from the driver's seat. The mixture is controlled by two levers on the dashboard, which are within easy reach of the driver, and the same levers are used for switching over to petrol. When running, the speed is controlled by a separate throttle lever and the regularity of speed is ensured by means of a governor operating on the same throttle.

There is a small hand-operated fan to create the necessary suction through the producer for starting up. It is connected to the pipe line near the inlet to the engine, and there is a cock on the outlet from the suction fan so that the pipe line may be shut off from the atmosphere when the engine is started. This outlet also serves for testing the quality of gas before attempting to start the engine.

The wood employed is preferably hard wood—oak, beech, elm, ash, &c.—though resinous woods can be used, if hard woods are unobtainable, provided that they are perfectly dry; wet woods release too much water in the "Gazogene." Waste wood of all kinds from saw mills, and toppings of trees with the bark on; in fact, any rough timber is suitable, provided that it is cut up into pieces of not more than 4in. cube. The makers assert that the running cost for wood fuel and lubricating oil for a 15-ton "Gazogene" motor roller is only 2d. per hour, that figure being based on the use of waste wood at 10s. per ton, and a consumption of 20 lb. of wood per hour. This running cost is claimed to be lower than that of any other road roller of any type. Using the gas only as fuel, the engine can be started from cold in three minutes.

The engine of the roller is of the firm's standard pattern, excepting that the pistons are of special construction, so as to give slightly higher compression, the compression ratio employed being 5 to 1. The rollers fitted with "Gazogenes" are at present of three weights—11¼ tons, 14¼ tons and 16 tons respectively—in working order, water ballasted and with an awning and three-tyne scarifier fitted. The engine is of 36 B.H.P. and is of the four-cylinder vertical type, with 4¼in. bore and 5½in. stroke.

We may add that we were informed, regarding the particular roller exhibited, that it left Peterborough at 7.20 a.m. on November 5th, and arrived at the Royal Agricultural Hall at 1.45 p.m. on Sunday, November 6th. The distance travelled was 84 miles, and the actual travelling time 23 h. 40 min. The fuel used consisted of tree toppings at 10s. per ton, and the total weight used on the journey was 6 cwt. 18 lb., or approximately 30 lb. per hour, or 8½ lb. per mile. That works out at an average fuel consumption per eight-hour working day of some 2¼ cwt. for this roller, which weighed as it stood about 15 tons. The consumption of petrol was, we are told, approximately 7 pints, and of engine crank case oil 4 pints. The radiator temperature is given as being

FIG. 5—THE "TRUCTRACTOR"—MILLARS MACHINERY COMPANY

145 deg. Fah., and that of the suction producer gas 100 deg. Fah.

Messrs. Barford and Perkins have also been experimenting with high-speed crude oil engines for road rollers, and have now developed a high-speed solid-injection Diesel engine which, they state, has given complete satisfaction on varying classes of work under extreme climatic conditions. One such roller was exhibited. It is of the three-wheel water ballast pattern and has a weight in working order of about 10 tons. Its engine develops from 30 to 35 B.H.P., and it is claimed that with 2 gallons of fuel the machine will do work equivalent to that effected by 3 gallons in the usual petrol or paraffin engine.

The stand also contained a number of other rollers, &c., but we have no space to allude to them in detail.

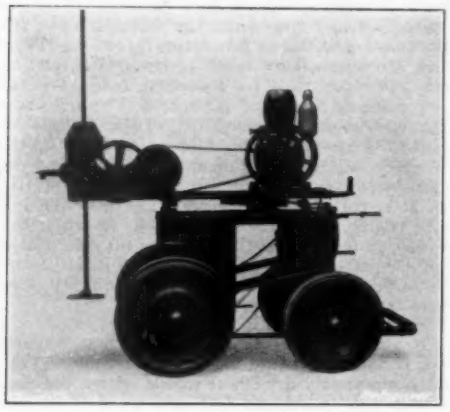


FIG. 6—THE "MIDGET" TAMPER—JOHNSON

They represented for the most part the firm's standard products.

The stand of Millars' Machinery Company, Ltd., had much the same appearance as it had borne in past years. There was the huge 10-ton portable asphalt plant which we have before described, but we noticed certain alterations in its details—notably in the position of its elevator. Then, too, there was an assortment of the Millars'-Jaeger concrete mixers for various types of jobs, which have also been described before and do not call for special comment here. An attractive combination—the Millars'-Worthington portable compressor—was also on view. It comprises a single-acting "Duplex" compressor driven by a petrol engine through a flexible coupling, and appeared to be solidly built and to be capable of withstanding the rough usage that portable compressors have to undergo, nowadays, during "rush" road reconstruction jobs, &c. Then there were various pumps, concrete carts, &c., on this stand, but the machine which appeared to us to present the greatest amount of novelty was the "Tructractor," which is illustrated in Fig. 5, page 575. This vehicle, which is small, sturdy, and of the three-wheel type, is adaptable to many varying conditions. As its makers say, it may be used either to carry or to pull a load, or both. As to its capabilities it is claimed for it that: (*a*) it will exert a pull of 15 tons on the level; (*b*) it will carry its load up a 15 per cent. gradient under its own power; (*c*) it will turn in a circle with an outside radius of 10ft.; (*d*) it will go where a horse and cart or ordinary four-wheeled lorry cannot go; and (*e*) it will travel at 12 miles per hour. It weighs approximately 30 cwt. and it has a maximum load capacity of 1 ton 10 cwt., and an overall width, with steel wheels, of 53in., the wheel base being 81½in. It is furnished with an engine of 16 brake horse-power. The wheels are of the cast steel disc type, rubber tired.

B. Johnson and Son, of Wharfdene, Ilkley, showed two examples of their tamping machines, one of which—the larger—was very similar to the type which we illustrated and described when they were first introduced. The smaller machine, known as the "Midget," which is illustrated in Fig. 6, is intended for consolidating the refilling of trenches up to 2ft. 6in., and has been specially designed to meet the growing demands of road engineers who may have to open a number of short lengths of trench in main roads, the maintenance of which is of great importance. As shown at the Exhibition, where it was operating on a sand-filled trench, it was being worked by an electric motor, but ordinarily it is supplied with a small petrol engine. The makers explained to us that, although the machine is lightly constructed, they have embodied in it the salient features of their larger machines, and that, being on rubber tires, it can be easily and quickly taken from one job to another so that a series of small gangs can be kept at work.

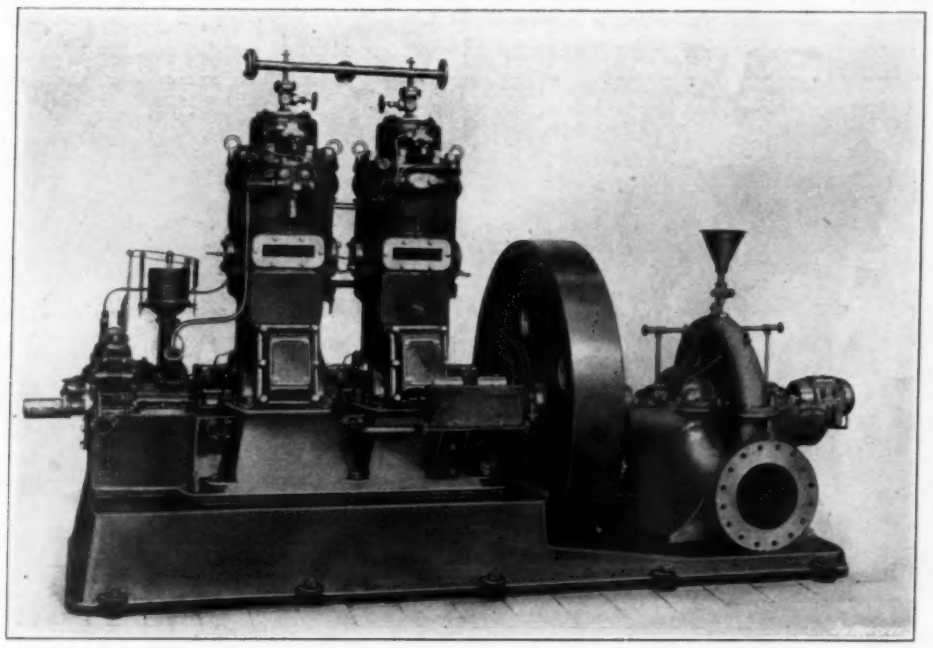


FIG. 7—70 B.H.P. TWO-STROKE HEAVY-OIL ENGINE—PETTERS

The most striking feature on the stand of Petters Ltd., of Ipswich, was a combined set consisting of one of the firm's new model "C" type two-stroke heavy oil engines coupled to a Mather and Platt centrifugal pump, the two being mounted on a combination cast iron bed-plate as illustrated in Fig. 7. The engine, which has two cylinders, 11in. bore by 12in. stroke, is designed to develop 70 B.H.P. at a speed of 350 revolutions per minute. The outstanding features claimed by its makers for their "C" type engine are its great simplicity and its comparatively low working pressures. The combustion chamber is completely water cooled and the ignition of the fuel when running is effected solely by the heat of compression. A compression pressure of approximately 300 lb. per square inch is employed, and the maximum pressure in the cylinders is, so we are informed, kept down to approximately 400 lb. per square inch. It is claimed that these pressures are very low in comparison with the pressures of the four-stroke cold-starting type of engine and that, consequently, longer life is given to the wearing parts. At the same time, it is pointed out that the fuel consumption compares very favourably with that of high-compression engines, being guaranteed at 0·43 lb. per B.H.P. per hour.

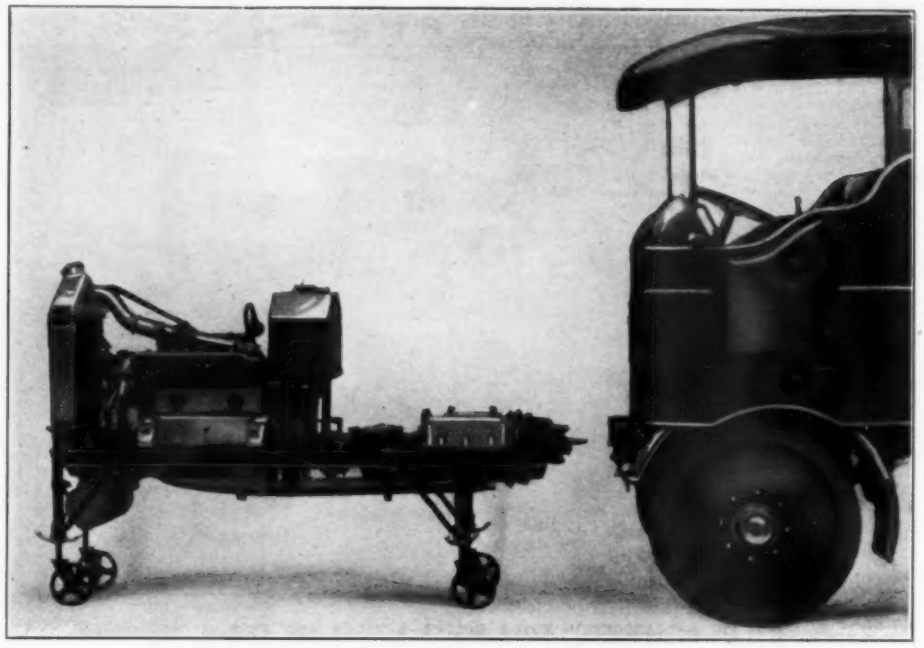


FIG. 8—MOTOR VEHICLE WITH POWER UNIT WITHDRAWN—LACRE

The other engines on this stand, which were, we believe, built at the firm's Yeovil works, were more or less of standard type and do not call for special reference saving that a small 5 H.P. portable petrol machine looked a very neat little job.

A distinctly new note was struck on the stand of the Lacre Motor Car Company, Ltd., of Letchworth, which showed a motor vehicle from which the engine, gear-box, radiator, and petrol tank units can be withdrawn, on a small trolley, in the space, it is said of ten minutes. A view of the end of one of these vehicles with its propelling mechanism withdrawn in this manner is illustrated in Fig. 8. Beyond this ability to withdraw the working parts there is nothing particular to note with regard to this type of vehicle. The company was also exhibiting a sweeping machine which was fitted with a 12 H.P. four-cylinder water-cooled engine. This machine has a sweep of 6ft. and is fitted with a 100-gallon water tank with pressure feed to the spraying gear. It is a one-man machine, all the controls being grouped in front of the driver, and as his seat is arranged in the rear of the brush, he has a clear view of the working of the machine.

(To be continued.)

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

THE MAN AND THE JOB.

SIR,—It is surely a little late in the day to throw doubts on the value to the engineer of a sound training in physics, mathematics, chemistry, and the other subjects coming within the curricula of our engineering schools. "We have only to look back," you remark in your leading article in this week's issue, "upon the number of notable inventions made by men with no scientific and often very little technical knowledge, to see that invention may spring from other sources than those which schools of engineering provide." The implications of that statement will not, I submit, bear examination.

It is not and never has been the aim of any engineering school or of any other educational establishment of which I have heard to train men as *inventors*. If there is such an institution in existence I shall be glad to hear of it in order that I may study its methods.

Most of our engineering schools are of relatively recent origin. Sixty years ago there were only two in the whole of the British Isles, one in London and the other at Glasgow University. Is it

your argument that the schools are to be blamed or criticised for their failure to inspire inventions made before they themselves came into existence ?

If we confine our attention to the years following, say, 1860, is your statement really true ? Which of the following are you prepared to describe as men having no scientific or very little technical knowledge—Graham Bell, Edison, Marconi, Hughes, Akroyd Stuart, Diesel, Parsons, Michel, Lilienthal, Wilbur and Orville Wright ?

Even although we admit notable inventions made before 1860, is your statement in essence any truer ? It is emphatically not true of James Watt, who had the advantage and protection of academic surroundings during the most important period of his career as an inventor. His separate condenser was definitely inspired by his work for the natural philosophy class at Glasgow University. Moreover, he was the grandson of a professor of mathematics and the nephew of another, and it was with the study of mathematics that his own youthful intelligence leaped into evidence—*vide* Dickinson and Jenkins' Memorial Volume, just published by the Clarendon Press. Equally is your statement untrue of Faraday, the whole of whose discoveries were made within the walls of the Royal Institution, an essentially educative foundation. It is only partially true of George Stephenson, but against that admission I would assert that he showed himself to possess just those qualities which make a good student and which would have been cultivated by a good engineering school. He certainly recognised the deficiencies of his training and bestowed particular care on that of his son Robert, whom he sent in 1822 to Edinburgh to attend the science classes at the University.

Time and again in reading the histories of the old engineers we encounter a tale of earnest striving after the acquisition of all the scientific knowledge open to them. I cannot believe that their inventions were any the better or came any the sooner for want of that quest being fully satisfied.

I am not disposed to maintain that our present system of engineering education is perfect and will await with interest reports regarding the efforts now being made in America to broaden the basis of the engineer students' training. It occurs to me, however, that the American attempts to which you refer may really have their origin in despair and a sense of past failure to encompass within a three or four years' course the ever-widening circle of knowledge required by the modern engineer. So extensive have the foundations of our profession now become that it is next to impossible to cover any section at all fully without neglecting other sections and unbalancing the whole curriculum.

London, November 12th. VIA VERITAS VITA.

SIR,—The remarks in your leading article this week under the above heading will, I am sure, be read with interest and approval by a great many of your subscribers, and they will also have followed with much appreciation the series of "An American Diary."

It may be of general interest to know of concrete examples of the schools of thought put forward, and I give my impressions of the results obtained.

Some years ago I was called upon to reorganise the engineering side of a large export merchant's business, and in view of the very varied range of the work, the question of the nature of the staff was of prime importance. After careful consideration it seemed to me that engineers with a sound general knowledge, and what may be called engineering common sense, would be most likely to develop the business successfully.

The results proved the correctness of my decision, and it was found that such engineers, besides their technical knowledge and perhaps because of the sound and broad basis of it, were able to handle quite successfully other matters not immediately connected with technical questions.

I feel that a special interest attaches to my experience, because, after a few years, new financial associations brought on to the board men obsessed with the "specialist" idea, and the exuberant favouritism shown to such men very quickly altered the balance of the staff and the specialists predominated. The effect on the business was almost immediate, and when a lull occurred in the particular speciality catered for and it was desirable to turn the energies of the staff to other engineering directions matters almost came to a standstill.

It seems, however, that with the "lay" mind the glamour of the specialist dies hard, and now a great part of my time is spent trying to coach the specialists to be generally useful, and an almost equal amount of time is spent in warning them of or retrieving them from the difficulties into which they fall—a well-nigh superhuman task to be done by correspondence several thousand miles away.

In citing this experience I do not wish to decry the specialist, but I am the more convinced by it that, while specialists are most valuable and often essential, they must, in the nature of things, be content in such business to be the sauce and not the joint.

After this evidence I am naturally endeavouring to break away from the handicap of such ideas and seeking a connection where—what I believe to be—the more effective methods will be accepted. ENGINEERING COMMONSENSE.

South Kensington, November 15th.

RECENT BRITISH LOCOMOTIVES.

SIR,—Your correspondent "C. E. P.," in your issue of the 11th inst., asks for general figures regarding the relative weights of compound and simple locomotives, doing the same work. I do not think this can be done, as there are no readily available quantities which give any real guide to a locomotive's capacity for work. With a simple engine it is impossible to say definitely what tractive effort will be developed at any normal running speed, and even experimentally one should find that there is no definite value of tractive effort for a certain speed. If a locomotive will steam at a certain cut-off at a given speed with an economical rate of firing, by increasing the rate of combustion or by shutting off the feed it could be greatly increased without the boiler pressure dropping, it is not economical in itself, but it is overload capacity which the compound as at present made does not have, and this means, in spite of the superior efficiency of the compound, that it has to be larger for a given job ; all the more so as the power output of a simple is fairly independent of speed, while that of a compound up to 50 m.p.h. at any rate is directly proportional to it. The compound could be given the same overload capacity and the same independence of speed as a simple by enlarging the cylinders as proposed by Mr. Rieke, but there must be some insuperable obstacle here, as it is never done, any increase in the cylinders being invariably accompanied by a proportionate increase of boiler capacity. Even the small increase in the L.M.S. compounds was not continued. I think the conclusion is obvious ; the normal compound even in full gear has an expansion ratio of about 2¼ to 1, and at slow speeds this does not supply sufficient draught to get the maximum results from the boiler. I am afraid I cannot agree with Mr. Reikie here ; after all, it is quite easy to make the blast as soft as desired, yet in many cases we find it made decidedly sharp with the sole object of increasing the rate of combustion.

As at present designed the compound not only has its cylinder output dependent on the speed, but has also that of its boiler. To get a flexibility approaching that of a simple engine it must have a rate of expansion that is variable to much the same extent as on a simple engine with the lowest ratio of not much more than 1¼ to 1, so that the blast when running slowly is sufficient to obtain the same output from the boiler as at high speed. These conditions would be fulfilled with a cylinder ratio of 1·3 to 1 and a H.P. cut-off varying from 85 per cent. to 25 per cent., the L.P. cut-off remaining at 80 per cent. This arrangement would give a maximum ratio of expansion of 5·2 to 1. The normal compound is usually only working at a 3 to 1 ratio or less ; it would also give equal division of power between the H.P. and L.P. with no receiver drop when working at 25 per cent. to 30 per cent. H.P. cut-off. Compare the rotten power division of the normal compound ; unless there is a very large receiver drop and consequent loss. We have now, of course, arrived at Mr. Rieke's original design, except that I would advocate two L.P. cylinders and quartered cranks.

With regard to "M.I. Mech. E.'s" contention that there should be no call for a high-speed compound to develop a coal engine's tractive effort, unfortunately there is, rightly or wrongly; both the G.W.R. and the L.M.S. expect their big-wheeled locomotives to do work that does call for such tractive effort.

Cookham Dean, November 14th. C. M. KEILLER.

SIR,—It is quite true that examples have occurred where established practice over many years has ultimately proved to be wrong ; but is this the case with the claim that expansive working of high-pressure steam plant is not economical ?

I have in mind the small Stanley steam car of some fifteen years ago, embodying a high-pressure engine geared direct to the differential and supplied with superheated steam from a tubular boiler carrying a pressure of 500 lb., the exhaust being discharged to the boiler flue and thence to the atmosphere, and it embodied all the characteristics of a small steam locomotive.

This car had one "link-up" notch for ahead running and when so driven was a free steamer and maintained a high average output, but if one forgot to link up after starting, one was soon short of steam ; this effect was even more noticeable with the hand-to-mouth system employed in the Gardener-Serpollet cars with flash boilers and poppet valve engines ; but in both cases linking up was not only advantageous, but with the small boilers used was imperative. It would therefore seem that what applies in small sensitive plant of this type would still hold in principle in larger powers.

There seems to be a tendency in all engineering thought to upset even the results of established practice for the sake of argument. One wonders whether it leads to any beneficial results to-day.

Mr. Rieke's claim for the old Webb compounds is borne out by the remarkable work done by Jeannie Deans and others of her class, and I believe that these engines were noted for their easy running once started, but I recall frequently seeing a small shunter called into action to push off heavy trains when the Webb compounds failed to start them. A booster in combination would have been a valuable asset to this type of locomotive. French practice and international theory would certainly seem to vindicate compounding, but possibly the psychology of the engine crew is a truer test of the matter. It is reassuring to feel anyhow that some success (or failure) is still to be determined by the human element, and that that admirable example of skilled labour, the engine driver, has not so far degenerated into a mere Robot. S. P. CHRISTIE.

Starcross, November 14th.

ELASTIC MATERIALS.

SIR,—I venture to bring forward a fundamental engineering problem which becomes increasingly difficult by delay. What is an elastic material ?

The terms "plastic material" and "elastic material" are familiar to every engineer. The first term conveys the notion that a material in a plastic state will yield when stressed and will not return to its original shape when the stress is removed. As to the second expression, an engineer is taught that an elastic material is one which obeys Hooke's Law, i.e., that the strain produced is simply proportional to the applied stress. If a test bar be placed in a testing machine and subjected to various stresses, and if corresponding strains be measured, a graph can be plotted called the stress-strain line of the material. This is usually done in tensile tests, but where sufficiently reliable measuring appliances are available is applicable also to compression tests. (The stress-strain line is not to be confused with the load-extension line, which is commonly plotted.)

Within certain limits of stress mild steel gives a straight stress-strain line which becomes a curve at higher stresses before the plastic state is reached. But the published results of tests on, for example, cast iron, concrete, or cast steel show definitely that these materials have no straight part on their stress-strain lines.

I venture to assert that indiarubber, within certain limits, is an elastic substance, and that such constructional materials as cast iron, concrete, and cast steel may be for all practical purposes considered elastic substances throughout the whole range of their stress-strain graphs from zero to breaking stresses, although in no case do they obey Hooke's Law as generally stated.

Current engineering literature contains many implied criticisms of the straight line elastic theory, and I beg to submit for your readers' consideration that Hooke's famous postulate would be more accurately translated as "In an elastic material, strain is some function of the stress," and would submit that the relation is not necessarily a linear one. A. C. VIVIAN.

Abadan, October 31st.

BESSEMER BASIC STEEL.

SIR,—As I am away from home I cannot verify Mr. Skelton's quotation, but in any case I did not write the passage he quotes.

After I have explained how I came to write the article he criticises, I regret Mr. Skelton still says I had ulterior motives in writing it, and that I say one thing at one time and one at another.

I read the article which Mr. Skelton contributed to *The Times*, to which he refers your readers, and it did not strike me as having been written in the spirit of pure scientific detachment which he enjoins upon me. The impression left upon my mind was that of a lament that the British steel maker resembled a creature described in the French child's picture book—"this animal is very wicked—it defends itself when it is attacked."

London, November 10th. JOHN W. HALL.

TRADES UNIONISM IN 1827.

WE have had brought to our attention, by Mr. A. L. Johnson, the managing director of Rd. Johnson, Clapham and Morris, of Manchester, a recent reprint of the rules and regulations of the Manchester Friendly Society of Wire Workers, which was established just one hundred years ago, and we would commend these rules to the attention of present-day trades unionists. In those days national politics were no concern of the worker, and throughout the twenty-one rules of the society there is no hint of interest in parliamentary affairs. On the other hand, the personal welfare of the men was obviously the first aim of the society, while their good behaviour, to their mates and their masters, was of first importance.

A quaint little sidelight on the cheerful way in which the society's meetings were conducted is given in the second rule, which stipulates that each member should contribute a shilling to go to the "stock and fourpence for liquor, whether he were present or not." There is other evidence that the meetings were held in a public house, as it was arranged that the landlord should be responsible for the safe keeping of the coffer, or box, as it was called, while there were fines for drunkenness.

It is evident that in those days the wire-drawing trade was even more closely guarded than now, for the men had to report to the society the advent of a new boy into their shops, or pay a penalty of five shillings, while "If any member of this society shall suffer a reduction of prices, for work done in a workmanlike manner, he shall be fined ten shillings and sixpence if he do not acquaint his shop-mates or the society at the time such reduction takes place ; and if they (his shop-mates) do not call a meeting of the trade, they shall be fined in the sum of ten shillings and sixpence each."

Some idea of the cost of living a hundred years ago may be gathered from the fact that a man out of work received ten shillings a week, with three shillings for a wife and one shilling for each child. On the death of a member his widow received two pounds ten shillings.

The address, with which the booklet opens, signed by the officers, merits quotation both for its style and its matter: "Owing to certain evils having been introduced into our trade, especially of late, it has been deemed essentially necessary to form the present society in order, if possible, by legal and fair means, to remove existing evils, and prevent their recurrence in future ; by doing which, according to the best of our judgment, we have equally considered the interest of our employers as well as our own. We have therefore agreed to meet at stated times, and contribute according to rule, to raise a fund to alleviate the sorrows of our members who cannot obtain employment, and restore the trade to, and maintain it in a position, whereby we may be enabled to provide 'things needful in the sight of God and men.'"

TRIAL RESULTS OF THE MOTOR VESSEL ITAPÉ.

WHEN describing in our last issue the 370ft. motor passenger and cargo vessel Itapé, which has been built by William Beardmore and Co. Ltd., for the South American service of the Companhia Nacional de Navegacao Costeira, of Rio de Janeiro, we were only able to give a summary of the trial results. Further particulars have now come to hand which show the comparative performance of the ship with her machinery running unsupercharged and supercharged. A full description of the ship and her machinery will be found in THE ENGINEER of November 11th.

Item.	2 hours' run, unsupercharged.	4 hours' run, supercharged.
Total I.H.P.	4370	4780
Total B.H.P. deduced from torsionmeter	3320	3625
Average r.p.m.	133	137
Average exhaust temperature, deg. Fah.	850	860
Air injection pressure, lb. per sq. in.	900	900
Supercharged air pressure, inches water column	—	25
Total Diesel oil fuel used in lb.	2850 (in 2 hours)	5925 (in 4 hours)
Fuel per I.H.P. hour, main engines	0·327	0·31
Fuel per B.H.P. hour, main engines	0·43	0·407
Boiler fuel used in auxiliary boiler, lb.	1400 (2 hours)	4048 (4 hours)

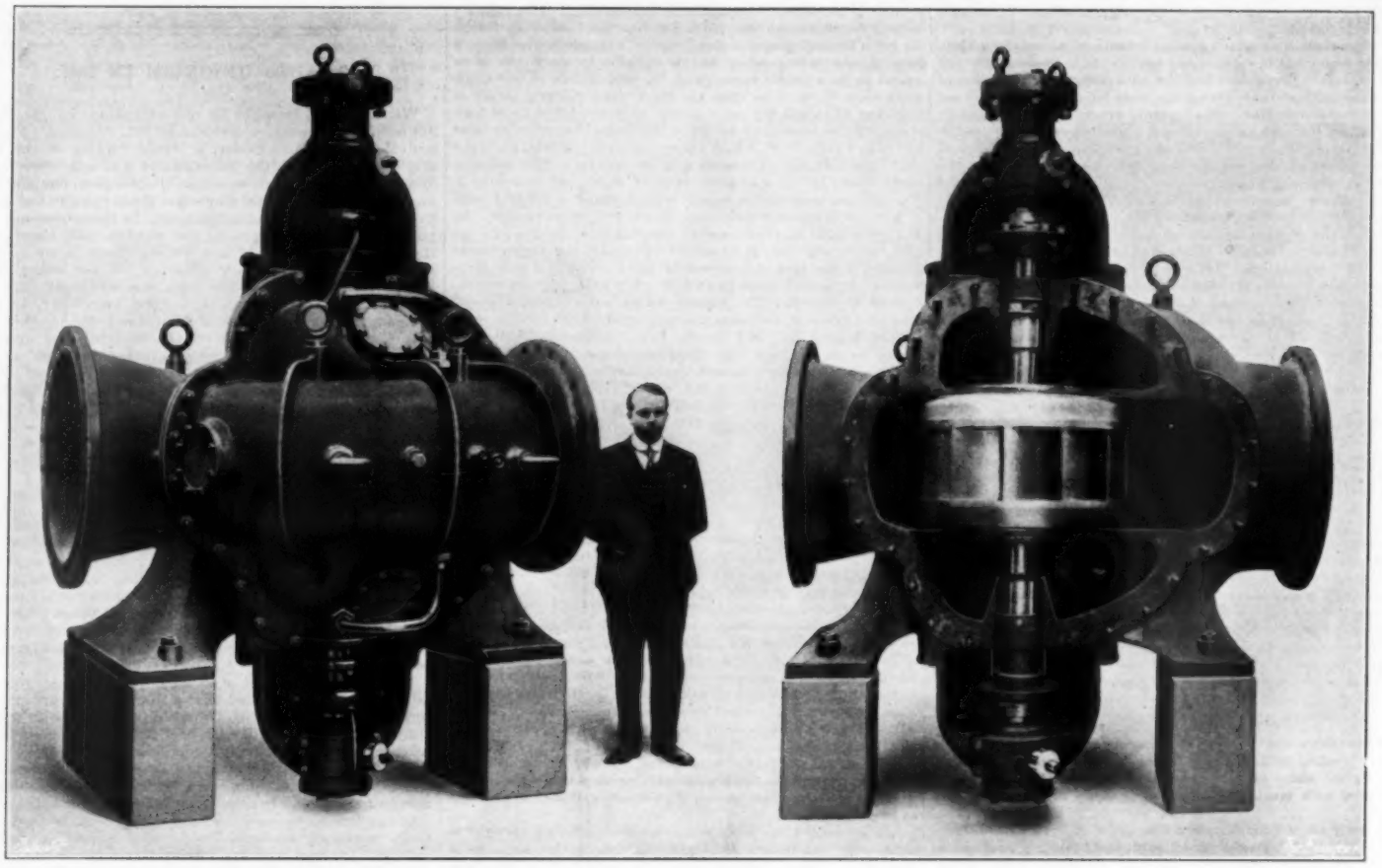
The average speed was about 14 knots and the engines were shown to be capable of operating at a minimum speed of 33 r.p.m. The time taken to reverse the engines from full speed ahead to full speed astern was only 25 seconds.

After the above trials had been carried out up and down runs were made on the measured mile at Skelmorlie, when an average speed of 14·826 knots was registered, the engines developing an average total of 5450 I.H.P., or 4072 B.H.P., as deduced from the torsionmeter. The exhaust temperatures and the air injection and supercharging pressures were practically the same as are given above in the four hours' trial run under supercharged induction conditions, and the fuel consumption of the main engines was only very slightly in excess of 0·4 lb. per B.H.P. per hour.

THE Board of Trade has appointed a Departmental Committee to consider the present system under which candidates for certificates as master or mate on merchant ships are examined, and to advise whether any, and, if so, what alterations are required in the system under which the examinations are conducted, or in the subjects in which the candidates are examined.

VERTICAL-SPINDLE PUMP FOR ADELAIDE POWER STATION

THE REES ROTURBO MANUFACTURING COMPANY, LTD., WOLVERHAMPTON, ENGINEERS



Extensions to Circulating Water System at Adelaide Power Station.

Some extensions to the circulating water system at the Osborne power station of the Adelaide Electric Supply Company have recently been carried out, the pumps and accessories being supplied by the Rees Roturbo Manufacturing Company, Ltd., of Wolverhampton.

The Osborne power station, which was described in the issue of The Engineer for August 7th, 1925, is interesting for several reasons, not the least of which is the nature of its circulating water arrangements. To make clearer the conditions under which the plant that we are about to describe has to operate, it will be as well perhaps if we give a brief explanation of the original circulating water system, the capacity of which it recently became necessary to enlarge. The station is situated 15 miles from Adelaide on an estuary of the sea known locally as the Port River. Owing to the sandy nature of the ground, it was not possible to excavate for low-level circulating water ducts direct from the river to the engine-room. Consequently, a pumping chamber was built as close to the river as possible, and the water is pumped from a sump formed centrally in it to the engine-room through high-level ducts. The pumping chamber stands on a reinforced concrete caisson, 61ft. outside diameter by 45ft. deep, with walls 2ft. thick. This caisson, which was completed in 1921, was then believed to be the largest diameter open caisson built up to that time. To construct it, the lowest portion was formed on the site, with a knife edge ring at the bottom, and the weight of the shell, as it was built up, was sufficient to cause the structure to sink through the sand for a certain distance. The enclosed soil was then excavated, further sections added to the wall as the structure sank, and, finally, at a depth of rather over 40ft., a solid foundation was met with. The bottom of the caisson was then closed with a floor of concrete, and the pump chamber constructed above the open top of the caisson.

The circulating system was designed to deal with the ultimate capacity of the station, namely, 60,000 kilowatts, though at first generating plant of only half that capacity was installed. The circulating water pipes were made of reinforced concrete, 5ft. internal diameter, and, with full load on the station, the calculated velocity of the water passing through them is 5·5ft. per second. They were designed for a working head of 35ft., and so far as was known at the time they were put to work, they formed the first example of the use of reinforced concrete pipes of large diameter for a circulating water system dealing with such a head. The pipes themselves, which have walls 3in. thick, heavily reinforced, were made in Adelaide at the Hume Pipe Company's works by the centrifugal process, and were the largest made by the company up to the time of their installation. Each had a length of 8ft. and each weighed about 2 tons. The joints were made with concrete collars caulked with bitumen, and neat cement filling. Two lines of pipes were laid, and they rest for their entire length on a reinforced concrete mat placed 8ft. below reclaimed site level, supported on piles at 4ft. intervals. The route length of the circulating system from inlet to discharge is 1300ft., and the distance along the river frontage from inlet to discharge is 500ft.

The original pumping installation comprised three motor-driven 32in. centrifugal pumps, made by W. H. Allen, Sons and Co., Ltd., each coupled to a 250 H.P. motor, and each designed to deal with 1,000,000 gallons per hour when working against a head of 35ft. The two new units which have just been supplied by the Rees Roturbo Company, are electrically-driven pumps of the vertical spindle type, the pumps being of the firm's well-known pressure drum pattern—see Fig. 2. Each unit is designed to deal with 1,250,000 gallons per hour of sea water when operating against a total manometric head of 40ft., and when running at a speed of 480 revolutions per minute, for which duty 325 brake horse-power is absorbed. As they have to pass sea water, the impellers are made of gun-metal, and the shafts are furnished with gun-metal sleeves. The casings are of cast iron and they are split across on the diameter, so that, by removal of the cover, the whole of the internal parts of the pump can be uncovered for inspection without the shaft or the general alignment being disturbed in any way. A view of one of the pumps with its cover removed is shown at the right-hand side of the above half-tone engraving. The casing has substantial feet for standing on heavy concrete foundations in the pump house. The positions of the two units as arranged in the pump house over the caisson is shown in Fig. 1.

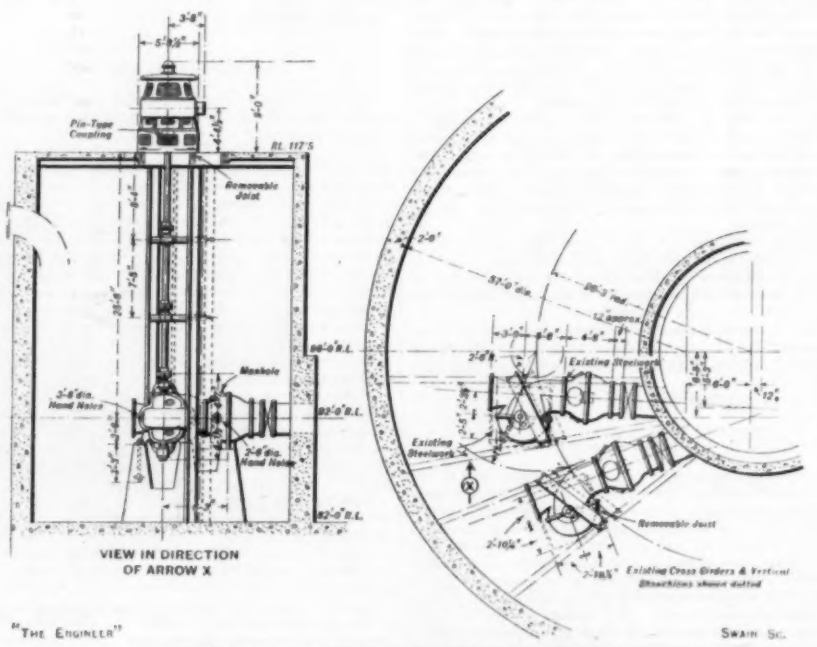


FIG. 1—ARRANGEMENT OF PUMPS AND MOTORS IN PUMPING CHAMBER

The difference in height between the centre of the pump and the floor of the motor chamber is 25ft. 6in., and the motor drives the pump by means of vertical steel shafting supported by intermediate bearings. The weight of this vertical shaft, together with that of the impeller and its spindle, is carried by a Michell thrust bearing fixed in the sole plate of the motor, a non-rigid coupling being arranged above that bearing for coupling the pump spindle to the motor armature.

Our readers will remember that the self-regulating features of the pressure drums of the Rees Roturbo pumps render it impossible for the motors driving them to be overloaded, no matter what variation takes place in the total lift or in the volume of water passing through them. This feature is obtained by letting the water issue from the pressure drum in a direction rearward to that of the rotation, with the result that a reactive turbine effect is obtained, and energy is returned to the prime mover. When larger quantities of water issue from the pressure drums, as in the case with lower heads, more turbine effect is produced, and that tends to keep the power constant, as will be seen from the curves in Fig. 5, which is a diagram setting out the pump characteristics, as shown during the tests to which reference is made later. On account of this

attribute, no fine clearances round the impeller are necessary. Another advantage to which the makers draw attention, is that there are no wearing rings on the sides of the impeller, which revolves quite clear of the stationary side plates, as will be gathered from Fig. 2, which shows the pump in section.

The motors—see Fig. 3—are of the vertical spindle, enclosed, ventilated, shunt-wound type, and are furnished with auxiliary magnet poles. A fan is mounted on the shaft at the bottom of the casing to ensure ventilation and trically-operated circuit breaker. The closing of the several starting contactors is effected by a solenoid-type master switch, which presents several interesting features. The movement of the master switch is governed by an eddy-current retarder, an electrical device which gives a braking effect that varies with the armature current. If the starting load is heavy, the master switch operates slowly, and the starting contactors, in like manner, close slowly. If, on the other hand, the starting load is lighter than normal, the starting period is, correspondingly, shorter. moving parts, and the pressure of the contact springs, serves to return the switch promptly to the "off" position.

The action of the master switch is, of course, to close, in sequence, each of the several starting contactors, thereby cutting out the corresponding steps of starting resistance. The individual starting contactors do not call for any particular description, except that, owing to the method of control by means of the solenoid type master switch, there is no necessity for side switches, relays or similar devices.

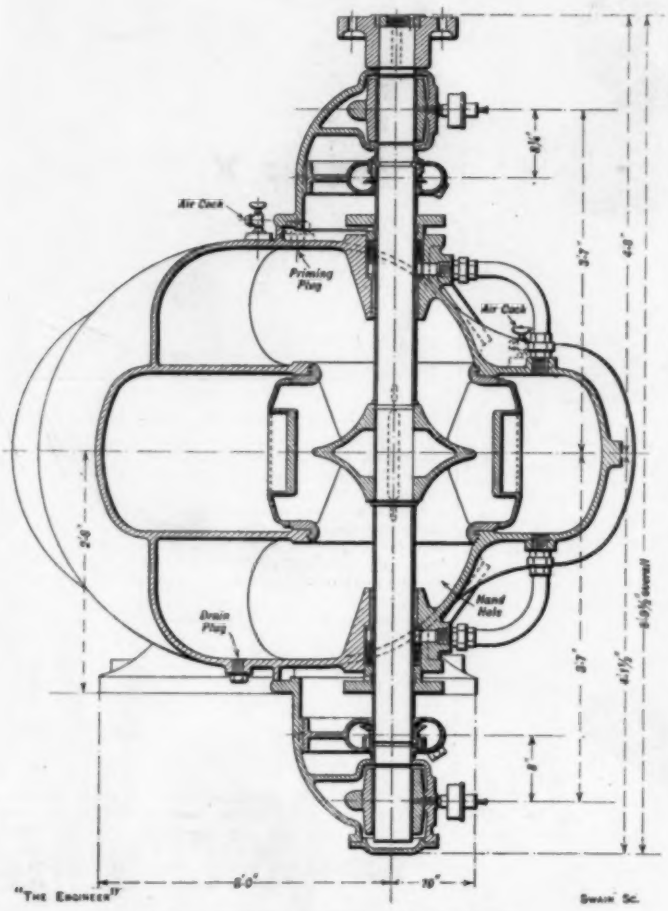


FIG. 2—VERTICAL SECTION THROUGH PUMP

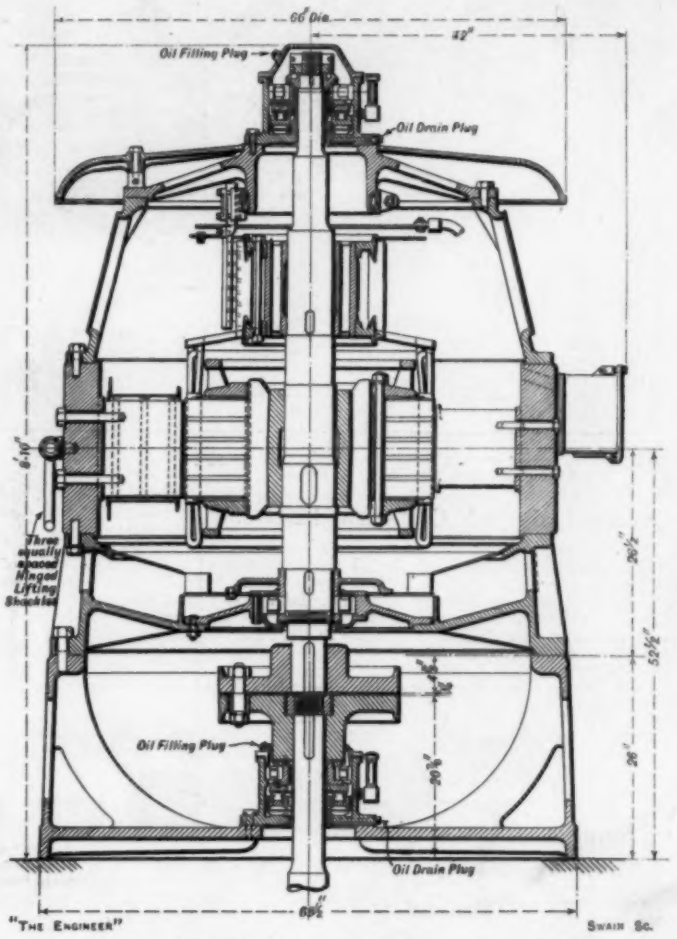


FIG. 3—VERTICAL SECTION THROUGH 400 B.H.P. MOTOR

cool running. Each motor is designed to develop 400 B.H.P. continuously, at a normal speed of 480 revolutions per minute, with a speed variation between 455 and 504 r.p.m. They comply with B.S. specification 168/1926 in all respects. Roller bearings are arranged underneath, and Michell thrust bearings at the top for carrying the weight of the armatures, and a canopy is fitted at the top to protect the motor from chance moisture getting into it. All small fittings are of non-ferrous metal to withstand the action of salt water.

In addition to the duty set out above, for which an efficiency of 80 per cent. was guaranteed, the sets had to

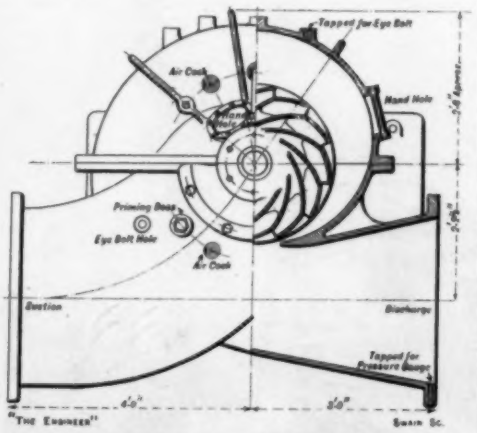


FIG. 4—PART CROSS SECTION THROUGH PUMP

run at 5 per cent. above and 5 per cent. below the normal speed, and at 5 per cent. above normal the efficiency guaranteed was 80·3 per cent., while at 5 per cent. below normal the guaranteed efficiency was 76 per cent. Curves showing the results obtained under test with one of these pumping sets have been supplied to us by the makers, and are, as already mentioned, reproduced in Fig. 5.

The sets are operated by Brookhirst controllers, arranged to suit 400 B.H.P. 440-volt direct-current motors and to give automatic control from a distant point by means of "start" and "stop" push buttons. Speed regulation from the control point is also provided for.

The main control panel consists of an automatic starter of the contactor type, together with a double-pole elec-

This self-adjustment is superimposed upon a hand adjustment of the retarder to suit the normal starting load. The makers emphasise the fact that the hand adjustment, no less than the self-adjustment, is of an absolutely definite character, there being no variation due to dirt, temperature or other external conditions, such as may be experienced when a master switch, governed by an oil dash-pot, is employed.

It is also claimed that, apart from the accurate adjustment, mentioned above, the solenoid type master switch

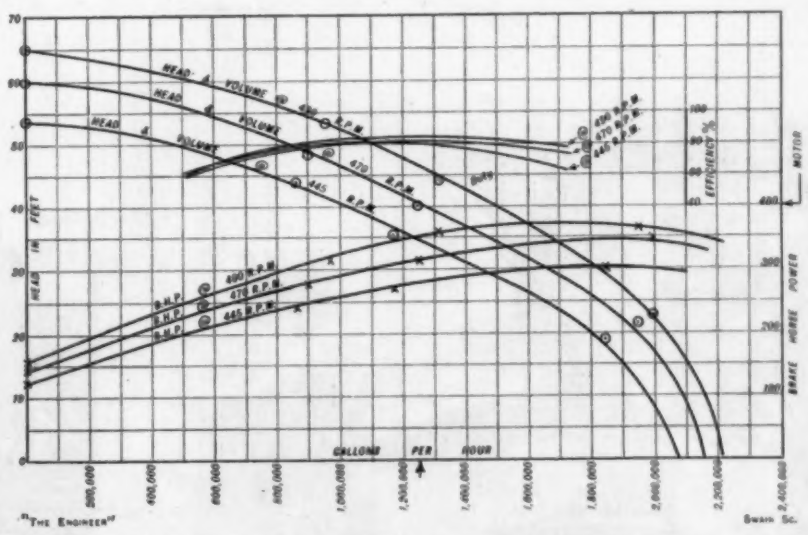


FIG. 5—CURVES SHOWING RESULTS OF TESTS OF PUMPING PLANT

is noteworthy for its certainty of action. The braking effect of the eddy current retarder is dependent upon the movement of the solenoid, so that it is impossible for the brake entirely to arrest the action of the master switch. Thus, whatever the starting conditions may be, there is no possibility of the motor running for a period with a portion of the starting resistance in circuit. When the master switch is de-energised, there is, moreover, no possibility of its sticking in the "on" position. There is no braking effect on the return movement, and all the weight of the

The motor itself is protected by two main contactors, and two overload trips.

The 33in. sluice valves are each operated by worm and worm wheel driven from a 2 B.H.P. Rees Roturbo motor, arrangements being made to stop the latter, automatically, by means of limit switches to prevent over-running. The reflux valves are of the multiple type, with gun-metal facings and a cast iron inspection door.

We understand that before the plant was despatched the pumps and motors were tested in a vertical position under full load at the maker's works, and came through the test successfully in every respect. The complete plant was made to the designs of Mr. F. W. H. Wheadon, M.I.E.E., the company's chief engineer in Adelaide, and of Messrs. Kincaid, Waller and Manville, of Westminster, who are consulting engineers for the installation, and in whose presence the trials were carried out in this country.

A RE-DESIGNED CAPSTAN LATHE

ALFRED HERBERT LTD., COVENTRY, ENGINEERS

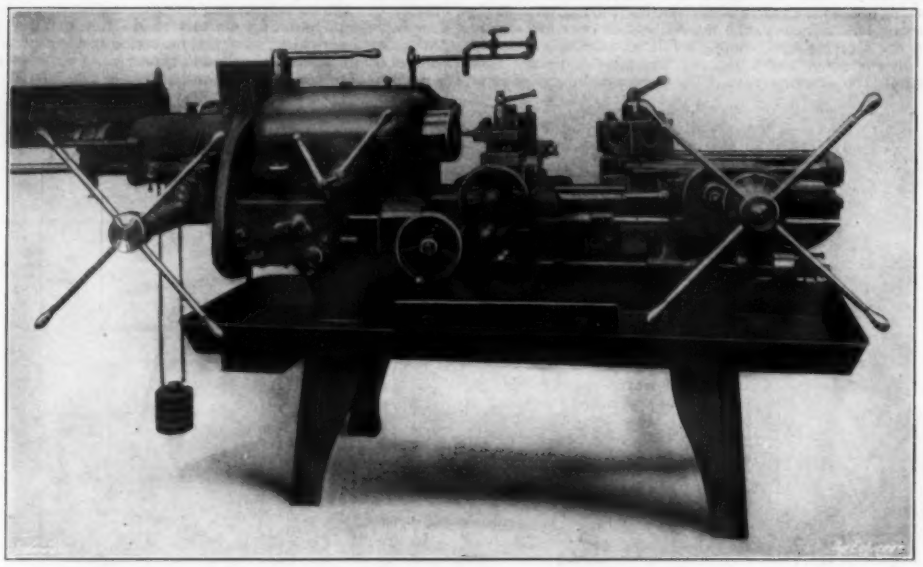


FIG. 1

A Re-designed Capstan Lathe.

THE original No. 4 capstan lathe made by Alfred Herbert Ltd., of Coventry, was produced as long ago as 1895. It has been produced continuously since that date, a fact which may be regarded as a remarkable testimony to the merits of the original design. The machine has recently been re-designed with the object of making it easier to install, safer to operate, of lengthening its useful life, and of increasing its productive capacity. The re-designed machine is shown in Fig. 1 as fitted with a draw-in chuck and an automatic bar feed for bar work. The lathe is also made with a plain head for chuck work.

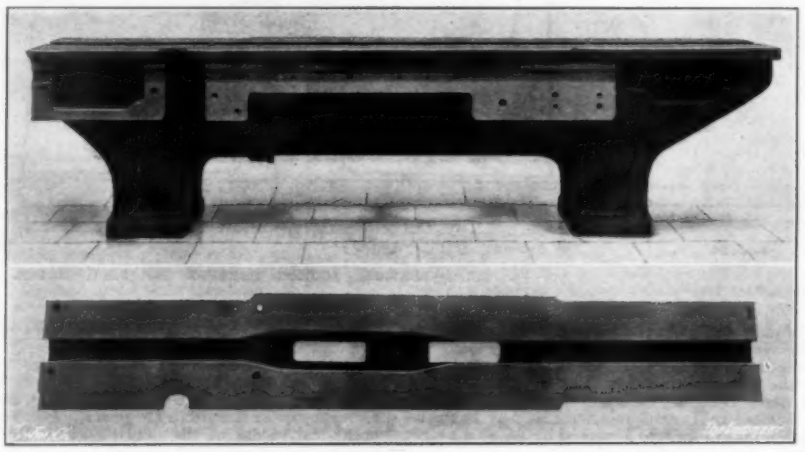


FIG. 2—FRONT AND PLAN VIEWS OF LATHE BED

The bed as illustrated in Fig. 2 has been considerably increased in depth, while the opening between the shears in front of the headstock has been widened to facilitate the escape of the chippings. For the same purpose two openings are now provided through the bottom of the box section. The height of the machine as a whole has been reduced to make it more suitable for operation by boy or girl labour. An adjustable belt guard, illustrated in Fig. 4, has been fitted round the main driving pulley. A subsidiary belt guard is bolted adjustably to the end face of the main guard, as shown in the illustration, to cover the pulley driving the pump.

The cross slide, Fig. 3, is now made of steel instead of cast iron. This improvement, in addition to making the chance of breakage much more remote, has the important effect of enabling a thinner cross slide to be used than formerly, and consequently enables work of increased diameter to be swung in the lathe. Steel, it may be added, is now also used for the large suds trays with which the machine is fitted with the object of reducing the chances of accidental breakage. The sliding motion of the chasing saddle has been fitted with six independently adjustable rotating stops in order to facilitate the accurate facing to length of a number of different shoulders on the work. In the new design all the important bearing surfaces are ground. For example, in Fig. 5 we give two views of the chasing saddle. On the underside—the view to the left—the saddle is ground on the flat bearing surfaces and on the vee edge. On the top—the view to the right—the saddle is ground on the flat surfaces and on the two vee edges. The cross slide of the chasing saddle is made of forged steel and is also finished with ground surfaces. In the same way grinding is used to finish the surfaces of the capstan saddle. A new feature in the design of the capstan saddle is to be found in the fact that it is clamped to the bed from a point on top of the capstan, an arrangement which, it is claimed, enables the operator to change the position of the saddle quickly and which enables a complete box sectional form to be used for the bed.

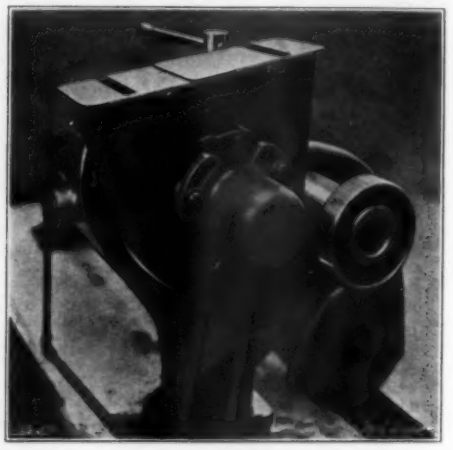


FIG. 4—ADJUSTABLE BELT GUARD

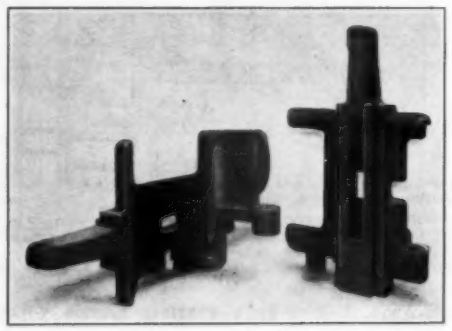


FIG. 5—CHASING SADDLE

In Fig. 6 we illustrate the lathe as arranged for producing the phosphor-bronze cross slide nut—Fig. 7—for the Herbert No. 9 combination turret lathe. The nut is held in a special fixture, the design of which will be obvious from Fig. 6. The first operation consists of centring the work ready for drilling. It is then drilled right through with a $^{19}/_{32}$in. drill held in the turret. At the same time the externally threaded portion of the nut is rough turned by a tool held in the square turret on the front of the cross slide. In Fig. 6 this turret has been removed for the sake of clearness. Thereafter the hole is trued up with a single-

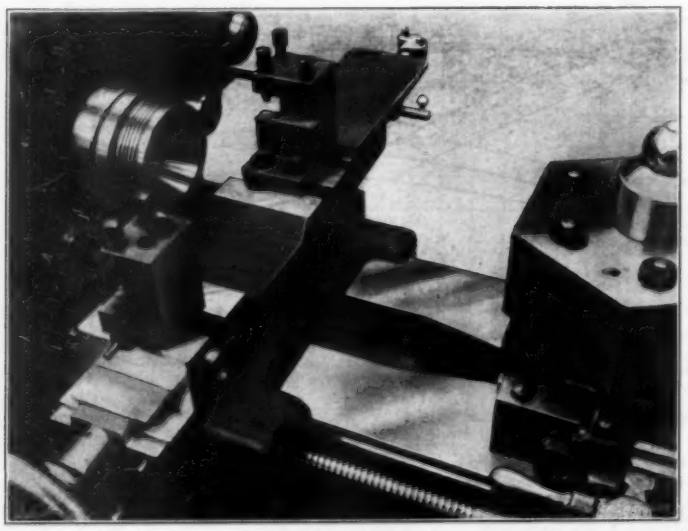


FIG. 3—STEEL CROSS SLIDE

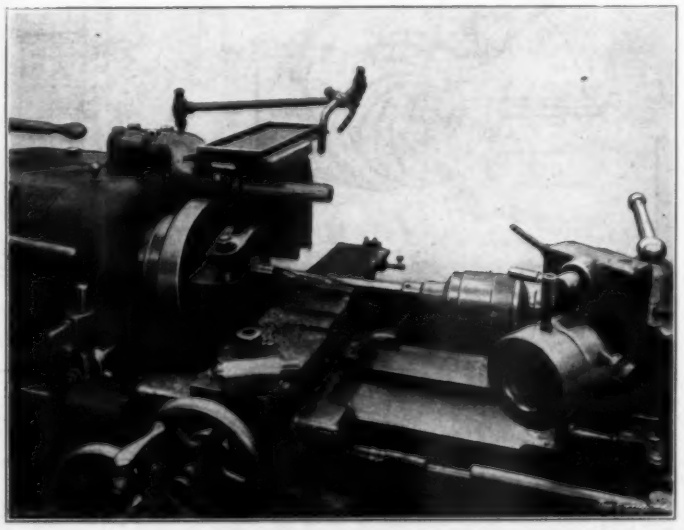


FIG. 6—LATHE ARRANGED FOR MACHINING A CROSS SLIDE NUT

point boring tool held in the turret, while simultaneously the threaded portion is finish turned with another tool held in the square turret. The next operation consists of reaming the hole to the finished size with a 0·625in. reamer held in the turret. The internal thread is then tapped by a series of SKF ground-thread taps held in a Coventry safety tapper. Six taps are used. They are ⅜in. diameter, ⅛in. pitch, ⅛in. lead, and have a left-hand double Acme thread. The tapping is done at a speed of 5ft. per minute and is completed in a total time of ten minutes. The succeeding operation consists of cutting the externally threaded portion by means of a Coventry die head held in an elevating holder. All these operations are completed in twenty minutes. The nut is then re-chucked and its opposite end machined and threaded, which

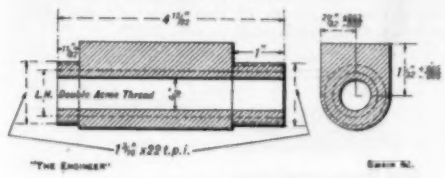


FIG 7—CROSS SLIDE NUT

operations are completed in a further five minutes. The work calls for a high degree of accuracy. As shown in Fig. 7, it is necessary that the hole should be parallel to within 0·003in. with the flat side of the nut throughout its length.

The machine as re-designed has a height of centres of 6¼in. and can swing up to 6¾in. over the cross slide. The spindle will admit bars of diameter up to 2in. and the draw-in chuck up to 1⅛in. The maximum distance from the end of the spindle to the face of the capstan is 28¼in., and the working stroke of the capstan is 9in. The centre of the tool holes in the capstan are 2¼in. above the top of the capstan slide. There are four automatic feeds available, ranging from 40 to 160 cuts per inch. The machine is made either with an ungeared cone pulley head or with a single pulley geared head as shown herewith. In the lathe form there are eight forward and reversed spindle speeds, which for general work range from 30 to 511 r.p.m. The machine absorbs 5 horse-power in its drive.

LAUNCHES AND TRIAL TRIPS.

BURSTEN, motor-driven tanker; built by Barclay, Curle and Co., Ltd., to the order of Tonsberg Rederi Company of Norway; dimensions, 400ft. by 52ft. 6in. by 29ft. 3in. Engines, opposed piston, airless injection oil type; constructed by the builders; launch, October 15th.

VOCO, oil tank vessel; built by Lithgows, Ltd., to the order of the Vacuum Oil Company, Ltd.; dimensions, 460ft. by 62ft. 6in. by 36ft. 6in. Engines, inverted, direct-acting, triple-expansion; pressure, 220 lb.; constructed by David Rowan and Co., Ltd.; launch, October 17th.

PALACIO, motor vessel; built by Harland and Wolff, Ltd.; to the order of MacAndrews and Co., Ltd.; dimensions, 270ft. by 39ft. by 17ft. 6in.; 1345 gross tonnage. Engines, six-cylinder, single-acting, motor; constructed by the builders; trial trip, October 19th.

VARAND, oil tanker; built by Sir W. G. Armstrong, Whitworth and Co., Ltd., to the order of the Baltic Trading Company; dimensions, 427ft. by 53ft. by 31ft. 6in.; to carry 8475 tons. Engines, direct-acting, surface condensing, triple-expansion, 27in., 45in., 73in., with 48in. stroke, pressure 180 lb.; constructed by the North-Eastern Marine Engineering Company; launch, October 24th.

CITY OF ROUBAIX, single-screw steamer; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of the Ellerman Lines, Ltd.; dimensions, 455ft. long; 10,710 tons deadweight. Engines, single reduction geared turbines; constructed by the Wallsend Slipway and Engineering Company, Ltd.; launch, October 25th.

KHETI, single-screw motor ship; built by Harland and Wolff, Ltd., to the order of James Moss and Co., Ltd.; dimensions, 345ft. by 47ft. by 30ft. 3in.; 2650 gross tonnage. Engines, eight-cylinder, four-cycle, single-acting Diesel; constructed by the builders; trial trip, October 25th.

OILTRADER, steel tank steamer; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of the British Oil Shipping Company, Ltd.; dimensions, 424ft. by 53ft. 5in.; 8600 tons deadweight. Engines, triple-expansion, pressure 200 lb.; constructed by the builders; launch October 26th.

BEAVERFORD, twin-screw steamer; built by Barclay, Curle and Co., Ltd., to the order of the Canadian Pacific Railway Company; dimensions, 520ft. by 61ft. 6in. by 40ft. 6in.; 13,000 tons deadweight. Engines, twin-screw sets of single reduction geared turbines, pressure 250 lb.; constructed by the builders; launch, October 27th.

KING EGBERT, motor cargo vessel; built by Harland and Wolff, Ltd., to the order of the King Line, Ltd.; dimensions, 400ft. by 54ft. 6in. by 34ft. 8in.; 4570 gross tonnage. Engines, six-cylinder, four-cycle, single-acting Diesel; constructed by the builders; launch, October 27th.

LEEDS CITY, steamer; built by William Gray and Co., Ltd., to the order of Sir William Reardon Smith and Sons, Ltd., dimensions, 400ft. by 54ft. 3in. by 28ft. 0¼in. Engines, triple-expansion, 25in., 42in., 70in. diameter with 48in. stroke; pressure 200 lb.; constructed by the builders; trial trip, October 31st.

LAURENTIC, steamer; built by Harland and Wolff, Ltd., to the order of the White Star Line; dimensions, 600ft. by 75ft. by 45ft.; 18,724 gross tonnage. Engines, four-cylinder, triple-expansion, reciprocating; constructed by the builders; trial trip, November 1st.

UGANDA, cargo steamer; built by D. and W. Henderson and Co., Ltd., to the order of Maclay and McIntyre, Ltd.; dimensions, 403ft. by 52ft. by 29ft. 10in.; 4965 gross tonnage. Engines, triple-expansion, 25in., 41in., 68in. diameter by 51in. stroke; pressure, 180 lb.; constructed by the builders; trial trip, 4th November.

ASHBY, steamer; built by the Cowper Dry Docks and Shipbuilding Company, Ltd., to the order of Sir R. Ropner and Co., Ltd.; dimensions, 420ft. by 53ft. 6in. by 29ft. 5¼in.; to carry 8650 tons deadweight. Engines, triple-expansion, 26in., 43in., 71in. by 48in. stroke; constructed by Blair and Co. (1926), Ltd.; launch, November 8th.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

General Conditions.

UNFORTUNATELY there is no improvement to report this week in the Midland and Staffordshire iron and steel trade. A few weeks ago there was more than a suggestion of spirited buying in the pig iron branch, but demand has eased off, consumers having satisfied their immediate requirements. On 'Change in Birmingham to-day—Thursday—steel masters spoke a little more hopefully of the situation, recent specifications having improved, especially for the higher qualities of steel, but the orders being given out are still few. Staffordshire ironmasters have better order books, an improved call for best grade bars having been experienced of late. The general market tone shows improvement, but business continues sluggish.

Pig Iron.

There has been no material change in the pig iron situation in this district on the week. Blast-furnacemen continue their efforts to keep up prices, while consumers maintain their policy of restricted buying, hoping thereby to bring down values. The pig iron contracted for a short time ago is not being absorbed very rapidly. Only those furnacemen who have outlets for their production in secondary manufactures appear to be under any pressure as to deliveries. There is very little new business passing in forge and foundry sorts, but trade in hematite shows some improvement. It was reported this week that a few very good contracts have been placed by heavy founders for North-East Coast hematite. Midland smelters quote Derbyshire No. 3 foundry £3 5s. 6d. to £3 6s., and Northamptonshire £3 0s. 6d. to £3 1s. Forge material, the demand for which remains almost negligible, is named £2 19s. for Derbyshire and £2 14s. for Northamptonshire.

Steel.

Midland steelworks maintain moderate activity, but the almost day-to-day buying which has been a feature of the steel market for some time still persists. This week there has been a little more inquiry for special high-grade steels, but very few orders for structural steel have been received, engineers being quieter than for many months past. This is considered to be but a temporary phase, and engineers are looking forward to better conditions in a few weeks' time. Competition between engineers is extraordinarily keen, and on some jobs taken lately it is positively asserted that the prices accepted cannot possibly carry a profit. Steelmasters who cater for the motor car industry have been short of orders for some little time, and the recent show has not given the stimulus to demand that they expected, though a few firms are now sending in substantial specifications. The plate rollers of the Midlands still benefit by their ability to give speedier delivery than the mills of the North of England, where the congestion on the railways continues to be a source of trouble. Steel prices are unchanged. Staffordshire hoops are quoted £10 10s. at works. Angles and joists sell at £7 12s. 6d; tees, £8 12s. 6d.; ship, bridge and tank plates, £8 7s. 6d.; boiler-plates, £11. Small bars make £7 12s. 6d. upwards, and soft billets £5 15s. upwards. Continental semi-finished steel is a shade firmer in price. Demand is not brisk, however. It is stated this week that one effect of the steel rebate has been to bring more business to Staffordshire re-rollers who are outside the scheme, but the much lower prices quoted by continental makers have led to a good deal of buying for stock by warehousemen who are not influenced by the slowness of deliveries.

Manufactured Iron.

Staffordshire wrought iron makers have benefited by the improvement in shipbuilding, and are receiving more orders for high quality cables and for chain making material. The orders received by makers of best bars have been spread over a wide range of consumers. These mills are well employed at the moment, and it is hoped to be able to keep plants running. There is no pressure of business, however. Prices are maintained on the £13 basis. Trade in Crown bars is still slow, but a slight improvement has been noticed since November came in. Competition is as keen as ever, and there is no closer consolidation of prices. Staffordshire bars are quoted at about £10 10s., but iron of this denomination from other districts is still offered at £9 12s. 6d. upwards. It is a long time since the price differences were so pronounced as at date. Makers of nut and bolt and fencing bars, with Belgian bars obtainable at about £5 18s. delivered, have no chance of securing any regular share of the trade. Staffordshire makers still quote £9 per ton for this class of iron. Wrought iron gas tube strip sells fairly readily at £11 10s.

Sheets.

Galvanised sheets of 24-gauge are not in ready sale, and prices are approximately the same as those of last week—£13 10s. upwards. Makers are unable to maintain full employment. New business is restricted to light gauges, much more work being wanted in the heavier classes of sheets. India has lately been a poor customer, carrying heavy stocks.

Scrap.

Steel scrap is very difficult to sell, but prices continue unchanged at £3 delivered in South Wales, and £2 10s. for steel turnings.

Trade Returns.

Midland industrialists were pleased to learn of the improvement in the trading situation as revealed by the Board of Trade returns for October. It was considered satisfactory that exports of manufactured goods last month should have been approximately £4,000,000 higher than in October last year, iron and steel manufactures showing an increase of £1,820,000. That imports of iron and steel manufactures should have been less by £418,000 was a further cause for satisfaction. It was noted also that there was a decline of £1,400,000 in imports of non-ferrous metals and manufactures. The total quantity of iron and steel imported during the month was 336,020 tons, valued at £2,560,902, compared with 398,235 tons and £2,979,284 in the corresponding month of last year. For the year to date the quantity imported was 3,840,841 tons, valued at £29,523,244, as compared with 2,800,465 tons and £22,373,437 in the preceding year. Facts which should not be lost sight of are:—Imports of manufactured goods show an increase of just over £12,000,000 on last year; there was a reduction of approximately £22,800,000 in imports of raw materials, due to the cessation of coal imports on a large scale; of the increase in exports, iron and steel manufactures accounted for close upon £10,000,000.

Rolling Stock.

Midland rolling stock makers report that though there are a fair number of inquiries circulating, the incoming orders fall a good deal short of the productive capacity of the carriage and wagon building shops. Buying has not kept pace with the requirements this year, either at home or in the principal markets overseas, and as replacement of wastage cannot be postponed indefinitely, and the construction of new railways and other development work in various parts of the world demand rolling stock for their economic exploitation, there are reasonable hopes of improving conditions in the near future. Should business not show progress, however, there must be a slackening of employment in some establishments which have been pretty regularly engaged for the past twelve months.

Edge Tools.

The edge tool industry in this area continues rather patchy, but, generally speaking, it shows improvement on the past six months. South American markets have toned up a trifle in the last month or so, but, on the other hand, the small spurt which had characterised business coming through from the East has not been maintained, and orders from this market are now somewhat scarce.

Egyptian Contract.

I learn that the Egyptian Delta Light Railways, Ltd., have placed with the Sentinel Wagon Works, Ltd., of Shrewsbury and Westminster, an order for twelve "Sentinel" locomotives.

Unemployment.

The latest returns show a further substantial increase in the number of unemployed in the Midlands. For the week ended November 7th the number on the live register was 134,209, as compared with 126,724 for the previous week, an increase of 7485. In Birmingham the increase was 365. In Coventry the improvement recorded last week is maintained, the latest figures showing a further fall, viz., from 4935 to 4756.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

Problems to be Solved.

THE statement of the difficulties of the British iron and steel industries made by the Hon. R. D. Kitson, who presided at the annual meeting in Manchester of Bolckow, Vaughan and Co., Ltd., merits the tribute that it was as unflinching as it was concise. No attempt was made to minimise the importance of what are the plain, cold facts of the situation. Due emphasis was laid on what is obviously the fundamental fact in the economics of the iron and steel industries, namely, that, whilst iron and steel products are only able to command prices which are 16 per cent. above those that were ruling before the war, compared with a general wholesale price level of 42 per cent. above pre-war, they are still very much higher than those at which foreign makers are able to offer their products, both in this country and in many overseas markets. Mr. Kitson upset a not uncommon fallacy when he said that the balance sheets of continental concerns suggested that the prices at which they sold were not unremunerative. At all events, he asserted, they were the prices with which British makers had to compete successfully if the steel trade in this country was to continue to exist.

The Way Out.

"Rationalisation" has been an important factor in the development of the steel industry on the Continent, but, largely because of legislative obstacles in this country, Mr. Kitson is not hopeful that this form of industrial organisation would be practicable here. He does, however, strongly advocate the policy of amalgamation—"co-ordination and co-operation of policy and effort, both technical and commercial," which, he says, are necessary for the maintenance and expansion of the British steel industry. The steel rebate scheme was described as an attempt in the direction of co-operation, though it was admitted that it was too early as yet to determine whether it would ultimately prove successful. Whilst it was agreed that new groupings could achieve much by improved selling, economical distribution of orders, and better financial accommodation, still more could be achieved by concentration upon the cost of production—by cutting down every item of expense which did not contribute adequately to the final result. High charges for inland transport, heavy dock dues and the burden of rates and taxes, which, said Mr. Kitson, were levied in such a way that they fell heaviest upon industrial properties such as collieries, coke ovens, blast-furnaces, and steel

works, were singled out as factors which added substantially to the cost of the finished products to the consumer.

Non-ferrous Metals.

Among the non-ferrous metals copper during the past week has continued its steady improvement, whilst in other sections of the market values on balance indicate an all-round recovery compared with a week ago. The demand for tin has been on a moderate scale, and as stocks of the metal are not regarded as excessive there has been a fairly substantial recovery in prices, notwithstanding periods of pronounced weakness which were in evidence on more than one occasion durir g the week. With regard to copper, although the buyir g movement during the period under review has been much less extensive than during the previous week, there has been a fair amount of interest displayed, and prices have further advanced. It is not without significance, however, that the rate of improvement has been much less pronounced than in any of the previous six weeks, and this lends weight to the expression of opinion during the last few days that the rise has probably reached its limit for the time being. The demand for lead is on a quiet scale, but in spite of the view that supplies of the metal are more than adequate to meet the present rate of consumption, prices in this section of the market have about recovered the ground lost a week ago. In the case of spelter there has been a slight improvement from the point of view of market values, but to some extent this has been in sympathy with the other metals, for buying remains on an unsatisfactory scale.

Iron.

The orders for foundry iron that have been booked on this market since last report have been numerically few, and in the aggregate have probably made little appreciable difference to the position of producers' order books. So far as consumption in this part of the country is concerned, however, makers still express satisfaction at the way in which delivery instructions against contracts are coming to hand, most of the Midland firms finding their current outputs pretty well taken up. It is understood that deliveries during the last two and a half months have been heavier than in any similar consecutive period for several years, and one market view of the situation is that if consumption during the next four weeks continues at the same rate, a resumption of buying on a fairly general scale should be experienced about the middle of December, or at all events early in the New Year. Against this it is argued that whilst prices were steadily falling up to about the end of August, users' stocks were allowed to get to abnormally low levels, and that deliveries since then have served merely to replenish these, and do not necessarily indicate an improvement at the consuming end of the trade. In the meantime, quotations are steady at about 73s. 9d. per ton for Staffordshire, from 73s. 6d. to 74s. for Derbyshire, 80s. 8d. for Middlesbrough, 89s. for Scottish, and 86s. for hematite, in all cases including delivery in the Manchester district. In the case of finished iron prices remain at £10 per ton for Lancashire Crown bars and £9 10s. for seconds, but the demand continues very quiet.

Steel.

Constructional engineers in this area, although still fairly busy, are buying steel very cautiously, and other consuming branches are also operating on similar lines. There has been some easing off in boiler plates recently, and offers of these on this market are available at from £10 5s. to £10 10s. per ton. The demand for them from locomotive builders, as well as for frame and general plates, has been rather better of late. Buying interest in steel bars is extremely limited, and there are indications of pronounced price cutting in this section of the market, current quotations ranging from £7 12s. 6d. or somewhat less than this figure for small re-rolled bars, up to £8 10s. Joists and sections are a quiet hand-to-mouth trade at £7 12s. 6d. per ton; whilst ship and tank plates are unchanged at £8 7s. 6d. Generally speaking, business in imported varieties of steel is slow, and competition among sellers is exceptionally keen. For delivery to consumers' works in the Lancashire area, for net cash against shipping documents, current quotations for continental finished and semi-finished steel products are as follows:—Thomas plates, £7 2s. 6d. per ton; Siemens plates, £7 10s. per ton; angles, £5 17s. 6d.; sections, £5 12s. 6d.; wire rods, £6 7s. 6d.; steel bars, £5 17s. 6d.; billets, about £5; and sheet bars, £5 2s. 6d. per ton.

BARROW-IN-FURNESS.

Hematite.

There is a pronounced quietness in the hematite pig iron market. Some makers are having to restrict output owing to accumulation of stocks. A furnace is going out at Ulverston and there is talk of two going out at Cleator Moor. On the other hand, another may be put in blast at Millom. There is an absence of forward booking, and customers are cutting down their orders for immediate delivery to a minimum. Fortunately, the steel departments are kept fairly employed, and these are taking a considerable quantity of iron. But for this fact there would be an immediate restriction of output. In some cases stocks have risen to about 30,000 tons, and until these are cleared there will be very little iron produced at those works. After a little spurt a month or so ago trade has fallen away, and signs of an improvement are not visible at the moment. America has taken a few deliveries, and there have been dispatches on a small scale coastwise. There is no life in the coal trade at present, but at the moment the steel trade is fairly well fixed, and orders are held for rails, &c., at Barrow which will keep the departments going for a month or two. Fresh orders are needed, but this does not apply to the hoop department, which is well fixed for work.

Shipbuilding.

Great satisfaction is felt here at the news of the placing of an order by the Orient Company with Vickers Ltd. for a passenger liner which, when completed, will be the largest liner in the Orient service and incidentally the largest passenger ship ever built at Barrow. The third of the modern Orient liners built for the Orient Line by Vickers, the Orford, was launched at the end of September, and is now fitting out in Bucclouch Dock. She is approximately 20,000 tons register, and 658ft. long, as were the Orama and Otranto. The new vessel will be, it is said, of new design, and will differ slightly from the latest ships in the Orient fleet. Such a contract, according to Commander Craven, means work for over 1400 men in Barrow on the average for twenty working months, which is a great comfort for the town generally. During the last four years the Orient Company has spent money at the rate of £1,000,000 per year on new shipbuilding.

SHEFFIELD.

(From our own Correspondent.)

Review of the Steel Trade.

It is difficult to find anything new to say about the various branches of the steel trade carried on in Sheffield and district. The position would appear to be summed up in the statement that the open-hearth basic side is in a very unsatisfactory state, and tends to get worse, while other branches are holdir g their own and in some cases are showing an improvement. Apart from times of industrial disorganisation, the production of basic steel was probably never before at such a low level as it is to-day. Work has declined in Lincolnshire, as well as Sheffield, and in both districts inquiries are on a very poor scale. It is difficult to account for this state of thir gs. Foreign competition will, of course, explain it in part, but not altogether. In acid steel there is no falling off; indeed, some makers and users of it find business somewhat more active than it has been of late. There is a rather better demand for railway steel, and work for the motor and electrical trades is maintained at a good level. Numerous orders come forward for forgir gs and castings, but individually they are small, and producers have no certainty of future work. Some firms which manufacture the lighter kinds of steel and special steel of various descriptions are well employed, but the total output of best tool steel is comparatively small and only a few makers are able to report continuous business. The call for heavy iron and steel works plant remains quiescent, but the requirements of the engineering industry show a steady improvement. While the file, saw, edge tool, and plantation tool sections are quiet, a fair amount of trade is being done in other tools.

Cutlery and Plate.

The cutlery and plate trades continue, in the main, to enjoy an amount of activity which, compared with recent years, is abnormal. The Christmas demand is largely responsible for this. Some firms state that trade is no better than the average, but others, including large ones, report that they are busier than they have been for some years, and, even though they are working late, they are finding it difficult to execute their orders in time. Shopkeepers have allowed their stocks to run low, and are anxious to replenish them before the public begin its seasonal buying. There is a gratifying improvement in the demand for silver and plate hollow-ware goods. While the call, as regards both cutlery and spoons, is chiefly for articles of the lower prices, there is at the same time a substantial trade in best qualities. The call for cheap bazaar goods is on a very large scale. Among up-to-date makers of silver and hollow-ware goods there is a good deal of confidence that trade will be well maintained next year.

Shipping and Railway Orders.

One of Sheffield's shipbuilding firms has booked a good order during the past week, the contract for a 22,000 ton Orient liner having been placed with Vickers Ltd. The vessel will be employed in the Australian mail and passenger service. She will be larger than the Orama, Otranto, and Orford, which were also built by Messrs. Vickers, and will, in fact, be the largest passenger vessel ever built at Barrow. Her speed will be 20 knots, and she will embody all the latest developments in marine architecture. The Goole Shipbuilding and Repairing Company has secured a contract to build a high-class coastir g steamship for Belgian owners, and also one for a powerful sir gle-screw steam tug for an Argentine company. In the realm of railway work there is good news for Sheffield in the announcement that the Yorkshire Engine Company has received an order for nine new tank locomotives from the London and North-Eastern Company, and Clayton Wagons, Ltd., of Lincoln, is to construct five articulated self-propelled steam rail coaches of the "Clayton" patented design for the Egyptian State Railways. The contract has been obtained in the face of powerful competition from continental manufacturers. The coaches required are of type similar to that of the ten recently ordered from the company by the London and North-Eastern Railway for branch line services.

Trades Technical Societies.

Among the most useful adjuncts of the Sheffield trades are six technical societies, formed some years ago under the auspices of the University. The societies hold frequent meetings, which are largely attended by those engaged in the respective trades, and their discussions on questions of workshop practice are of great value. The work of the societies has been stimulated by interest taken in them by the Armourers' and Braziers' Company, which a year ago agreed to make an annual grant of £150 to be distributed in prizes and certificates for papers written on improvements that might be introduced into the various trades. The scheme was initiated by the Cutlers' Company. The first distribution of prizes and certificates took place last Saturday night. The six societies are devoted respectively to the service of the cutlery, rolling and forging, silversmiths, file-making, tool and saw making, and foundry trades, and two or more prizes were given for papers by members of each society. Altogether, eighteen papers were sent in, and they were all described as creditable, some of them containing ideas that would be of use to the trades. Arrangements are being made to have the winning papers duplicated and placed at the University, so that they can be read by the members of the societies.

Municipal Matters.

Two or three Ministry of Health inquiries have been held during the past week with regard to municipal developments which are in prospect. The Corporation of Dewsbury desires to borrow £21,000 for the supply of filtering media at Mitchell Laithes sewage disposal works, £9968 for constr ction works at the same premises, and £4500 for a garage and other buildings at a Corporation depôt. Rotherham Rural District Council is proposing to spend £15,282 on sewage works extensions at Whiston, £4495 on conversions, and £2395 in respect of water supply. Mexborough has a scheme of increased water supply, including the acquisition of two wells and the necessary extension works, estimated to cost £8165.

NORTH OF ENGLAND.

(From our own Correspondent.)

Coal Trade Conciliation.

As the result of conciliatory efforts, there is every promise of a satisfactory outcome of the negotiations between the Durham mineowners and the men's representatives over the wages question. The negotiations have reached a satisfactory stage, and have helped very largely to do away with what threat there was of a stoppage of the pits. The offer which was made by the owners a fortnight ago has been favourably received by the men's representatives, and it is not likely that the recommendation of acceptance which has gone to the lodges will be turned down. A gratifying feature of the negotiations is that the men's representatives have shown a serious regard for the position of the industry and the necessity at the present time of co-operation with the employers to win through the prevailing depression, and this feeling, it is confidently believed, is wide enough in the county to ensure the amicable continuance of work. It has been conceded by the men's representatives that the Northumberland clause, whereby, on the application of either party, the District Board or, failing agreement, its chairman, shall be entitled to review the minimum addition to basis rates, should be inserted in the Durham county agreement. On the other hand, the owners have agreed to extend their claim for an alteration of the percentage for two months. In other words, the lower-paid men have the assurance that their wages will not be interfered with—at any rate before March.

Cleveland Iron Trade.

Though the volume of business passing in the Cleveland pig iron trade is much lighter than it has been, an optimistic tone continues to characterise the market. Following upon a period of fairly active buying, the present quietness is only what might have been expected, and is regarded as no more than a passing phase, which is likely to be of short duration. A considerable proportion of contracts recently arranged is understood to be for shipment to overseas customers, and to have been secured in face of keen continental competition. Odd lots of foreign iron are still arriving in the Tees, but to all intents and purposes the back of continental competition at home has been broken. Business with Scotland, however, is very quiet, foreign competitors continuing to secure a good proportion of the Scottish trade. A gratifying feature of negotiations over the past fortnight is the inclusion of inquiries for supplies as far ahead as June next, and some of the actual sales are reported to be for delivery beyond the end of the year. The outlook generally is regarded as encouraging, and confidence in continued steady trade development is rather pronounced. For home use, No. 1 Cleveland foundry iron is 70s.; No. 3 G.M.B., 67s. 6d.; No. 4 foundry, 66s. 6d.; and No. 4 forge, 66s. To Scotland and destinations overseas prices are 2s. 6d. below the foregoing.

Hematite Pig Iron.

An easier feeling is noticeable in the East Coast hematite pig iron trade, but prices are hardly quotably altered. Production is ample, and stocks at some of the works are slightly increasing. Makers are very keen to book orders, and do not hesitate to cut prices. Mixed numbers are in the neighbourhood of 72s., both for home use and export, but business is reported to have been put through at less than that figure. Sales are almost entirely of iron of special analysis.

Ironmaking Materials.

Business in foreign ore is confined to sales of odd cargoes. Consumers are well covered over the next few months, and are not disposed to buy, but sellers take a hopeful view of the outlook and hint at a possible stiffening of prices when negotiations open for renewal of contracts. Best Rubio ore is 21s. per ton, c.i.f. Tees.

Manufactured Iron and Steel.

Producers of finished iron and steel are actively employed, and the tonnage output continues heavy. There has been rather more activity in semi-finished steel, but consumers are still buying the substantially cheaper continental billets and sheet bars. Prices for galvanised corrugated sheets show a slight variation, owing to a fall of £3 per ton in the price of spelter. Corrugated sheets of 24 gauge are now quoted at £13 7s. 6d. Quotations for other finished iron and steel commodities are upheld.

The Coal Trade.

The position in the Northern coal trade is far from encouraging. Although a steady tone is maintained, there is some uncertainty for the concluding month of the year. The outlook is rendered all the more difficult to gauge on account of the increased coal production abroad and the keenness there is for any business offered. England

does not get a share of the export business now without continued alertness and a cutting of prices to the bone. The shipments from the Tyne this year to the end of October were nearly four million tons less than in 1913, and this is a reflection of the advance European countries have made in developing their own coal resources. There is so much coal available now that it would require an unprecedented boom to restart many of the idle collieries in Northumberland and Durham. For the present, the current restricted production is well booked, and quotations are steady. Northumberland best steams are well taken up for the rest of the month, and 13s. 6d. to 14s. is the quotation for early deliveries. Over next year second-hand holders are offering at 13s. Durham steams are in moderate request at 15s. to 15s. 6d. Gas coal pits have an occasional idle day, but the producers of bests and specials keep to a steady range of 15s. 6d. to 16s. 3d. There is a little more inquiry for coking coal, and sellers ask 13s. 3d. to 13s. 6d. for ordinary descriptions. High grades of bunkers have a firm tone, and prices rule from 14s. to 15s. 3d. Ordinary sorts are 13s. to 14s. The pressure for gas coke is unchecked. Supplies are scarce and for delivery to the end of the year 24s. 6d. to 25s. is firmly asked. Patent oven cokes are quiet and in buyers' favour at 17s. 6d. to 18s. for good sorts and 25s. to 30s. for special or beehive makes.

Coal Trade Depression.

Another colliery in Northumberland is to be closed down. Notices have been issued to the 400 employees of the Howard Pit of the Netherton Coal Company in consequence, it is stated, of bad trade. Recently the pit has been working on the double-shift system. About 730 men and boys at Harton Colliery, South Shields, have also received notices to terminate their employment, and these will expire on November 25th. There are about 2200 men and boys normally employed at the colliery.

SCOTLAND.

(From our own Correspondent.)

Markets Unchanged.

Business in steel, iron and coal continues to move on very quiet lines. Very little, if any, change has been noticeable for weeks back, and there are no signs of an early alteration in the situation. Here and there an occasional spurt has taken place, but there has been no real or lasting improvement. In ordinary times the gradually increasing activity at the shipyards would have had an early effect on steel and iron, but at present foreign material is a very keen competitor, with a considerable influence on home markets. Export business is as a rule scrappy, and it is questionable if the prices obtainable are remunerative. The effect of the rebate system on steel prices is not yet very apparent, but up to the present there does not seem to have been much benefit derived from the scheme. At any rate, the steel market, in common with others, is very dull. Some are of the opinion that continental prices are on the up grade, and are more hopeful in consequence, but the disparity between continental and home quotations for similar material is in many cases considerable, and the levelling process will take some time. Meanwhile home producers find markets dull and unresponsive, with an unchanged outlook.

Steel.

In the continued absence of business chief interest at present is centred on continental reports, which apparently indicate a firmer tendency in prices, more especially for pig iron, and foundry qualities in particular. Makers, however, are not disposed to attach too much importance to these reports in view of the wide gap existing between home and continental prices, already referred to above. At present the heavy steel works are only employed in a hand-to-mouth fashion, and fresh business is a pressing necessity. Fair orders for rails have recently been placed in this district by the railway companies. Steel sheet makers have fair demands for light gauges, but the heavier descriptions are somewhat neglected. Sheet prices are barely steady.

Light Rails.

The Light Rail Makers' Association has reduced the price of colliery rails by 7s. 6d. per ton in the case of bridge rails, and 5s. per ton for flat-bottom rails, the new prices being £7 15s. and £8 per ton respectively.

Iron.

The pig iron market is very sluggish. Orders are few and small, and prices weak, the restricted output being more than equal to requirements. The demand for bar iron is most unsatisfactory. Outputs hardly vary from a rate considerably below the capacity of the works. A quiet export turnover is reported at a price little, if anything, above £10 per ton. The home price is unchanged at £10 15s. per ton. Re-rolled steel bars and small sections are also inactive, with prices varying little from £7 15s. home and £7 5s. per ton export.

Exports and Imports.

During the past week over 14,000 tons of iron ore were discharged at Glasgow, also 2200 tons of steel and iron from the Continent. Shipments of steel and iron were fairly satisfactory, amounting in all to some 7000 tons, which were dispatched to Australia, South America, South Africa, New Zealand, India, the United States, Canada, Germany, and other destinations. Fair quantities of structural material, tubes, and machinery were also shipped abroad.

Coal.

The export department of the coal trade continues dull and unsatisfactory, partly owing to sustained keen continental competition. Certain descriptions of Scottish fuel maintain a firm position, owing to some covering of sales by shippers, but on the whole the collieries find difficulty in disposing of outputs, and some pits have been closed. Lanarkshire best splints are comparatively well booked for the Mediterranean and South America, and best ells for the Irish market and home consumption. Best Lothian and Fifeshire steams also are moving off comparatively well. Washed treble and double nuts are fairly steady, but singles have weakened. Aggregate shipments amounted to 246,917 tons, against 265,942 tons in the preceding week and 285,872 tons in the same week in 1925.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Conditions.

The long hoped for revival in the coal export trade has not yet matured, and at the moment there are no indications of its early materialisation. The demand from abroad is altogether on too small a basis, and most exporters are becoming resigned to the present quiet conditions prevailing throughout the remainder of this year. Shipments last week were a shade better than in the preceding week, inasmuch as the total amounted to just over 410,525 tons, as against rather more than 396,000 tons. This slight increase was very welcome, more especially as shipments of anthracite have fallen off consequent upon the suspension of shipments to Canada until next season. Still the present level of exports is insufficient, and should be round about half a million tons per week at least to put any life into the market. The cry at the moment is for prompt orders, and if they only improved it is certain that they would be followed by a much better inquiry for supplies ahead. As things are, there is a moderate demand for next year. The Central Argentine Railways have purchased their requirements over 1928, and they generally run to about half a million tons. They buy the leading qualities of Admiralties, and it is stated that they have now covered their needs for next year on the basis of about 19s. to 19s. 3d. per ton f.o.b. Other business which has shortly to be decided relates to the requirements of the French State Railways, the Egyptian State Railways, and the Algerian State Railways. The Peleponnesus Railways are reported to have contracted for 27,000 tons to 30 000 tons of South Wales patent fuel for delivery between now and the end of June.

To Assist Coal Trade.

There can be no doubt that South Wales coalowners are exploring every possible avenue for bringing about an improvement in the steam coal industry, because the position is serious. It is very well known that many undertakings have pretty well come to the end of their financial resources, and doubtless it was that fact that caused so many rumours to be current during the latter part of last week as to the course which coalowners were adopting in order to endeavour to remedy the situation. It was stated that the Coalowners' Association intended approaching the Government, not only regarding railway rates and dock charges, but respecting a long term loan at a low rate of interest in order to tide collieries over the present period of depression. The South Wales coalowners certainly had a meeting, but it was officially stated that no decision to approach the Government had been come to, and it is quite conceivable that many coalowners would strongly deprecate any such action if it can at all be avoided, as Government assistance might very possibly bring in its trail Government interference of an objectionable character. The proposed scheme regarding the stabilisation of prices has not yet been made public, but one step which the coalowners have taken, which is something new, is for them to enlist the support of the men's side in their movement to bring about a reduction in railway rates, &c. The subject came before a meeting of the Conciliation Board on Monday last, and there is to be a further meeting at a later date to consider the situation. Hitherto the proceedings of the Conciliation Board have been confined to discussions relating to wages and employment conditions, &c. At the meeting on Monday the coalowners' side put forward some very interesting information respecting transport charges. Mr. Evan Williams, speaking for the coalowners, pointed out that directly and indirectly the total effects of the increase in charges in 1927, as compared with 1913, involved an additional charge on the Welsh coal industry of over £4,£00 000 per annum. He mentioned the rates charged by foreign competing countries on coal sent for shipment as follows :—

	Average distance pit to port. Miles.	s.	d.	Rate per ton per mile. d.
South Wales	21	1	9	1·0
Ruhr to Hamburg ..	225	8	6	·45
Germany to Rotterdam	180	3s. to 3s. 6d.		·23
Poland	375	4	0	·12
United States..	400	11	0	·33

It was also pointed out that foreign coal producing countries were giving special concessions in order to assist their coals to compete with Welsh coals. A very interesting statement was prepared by the coalowners relating to railway and shipment charges, and this showed that in the case of the Great Western Company the average railway rates on all coal traffic conveyed (inland and shipment) was 1s. 5d. per ton in 1913 and 2s. 6d. per ton in 1927, an increase of 1s. 1d. per ton, this being exclusive of the increases made as from October 1st last. A statement relating to the cost of railway transport on 1 ton of tin-plates in South Wales shows an increase of 69·92 per cent. for inland destinations and of 74·48 per cent. for shipment. The cost of transport included in the selling prices of South Wales iron and steel commodities shows an increase from 15s. 7½d. to 23s. 9d. per ton on pig iron; from 17s. 6d. to 26s. 9d. on ingot moulds, and from 20s. 9·89d. to 32s. 4d. on billets and bars. These increases are exclusive of additional cost of delivery to destinations ranging from 40 miles to 90 miles from the works—averaging over 63 per cent. above the 1913 rates.

Tin-plate and Steel.

Work has been resumed this week at several tin-plate works which had been idle for several months. The Bryngwyn Steelworks have also put four of their steel smelting furnaces into commission. It is again reported that tin-plate manufacturers are considering the question of reviving the tin-plate pool in order to put more stability into the market.

Later.

A representative meeting of the Welsh tin-plate trade at Swansea on Tuesday decided to resuscitate the scheme for the stabilisation of prices. A fixed minimum price of 17s. 9d. per standard box f.o.b. works port was agreed, this to operate from Wednesday (16th inst.). The decision has the support of 90 per cent. of the trade, and the remainder is expected to fall into line. A scheme is also in preparation for bringing the output level with the demand, and this is expected to come up for approval at a meeting of the trade next Tuesday.

Current Business.

Day-to-day operations in steam coals have been on a very meagre scale, though the volume is believed to be a shade better than of late. The amount of business passing is insufficient to create any steadier tone in values, which have not undergone any alteration. Collieries are still working very irregularly as a consequence of the shortage of orders. There is no further news regarding the withdrawal by the French Government of the system of import licences, though information from a private source states that this withdrawal is expected to come about in a few days.

CALENDARS, DIARIES, &c.

The Association of Engineering and Shipbuilding Draughtsmen, 96, St. George's-square, S.W. 1.—Diary, 1928. Copy of the fourth edition of this diary.

D. Harper and Co., Ltd., 258–262, Holloway-road, London, N.—Harper's Engineer's Diary and Reference Handbook, 1928. Technical matter compiled by Mr. Chas. H. Adams.

Wm. Collins, Sons and Co., Ltd., Herriot Hill Works, Glasgow.—A copy of Collins' Engineers' Diary for 1928, which contains over a hundred pages of reading matter of use to engineers.

CATALOGUES.

James Wiley and Sons, Ltd., Eagle Works, Darlaston.—Revised price list of bolts and nuts.

British Insulated Cables, Ltd., Prescot, Lancs.—Publication 223, describing in detail "Aeroflex" cartridge fuses.

Allen Everitt and Sons, Ltd., Smethwick, Birmingham.—A booklet of tables dealing with tubes, bars and pipe fittings in non-ferrous metals.

Holden and Brooke, Ltd., West Gorton, Manchester.—List No. 144 of centrifugal pumps, heaters, calorifiers, injectors and other steam auxiliaries.

Moreland, Hayne and Co., Ltd., 80, Goswell-road, London E.C. 1.—Booklet on solid steel columns for the use of architects and constructional engineers.

Dewrance and Co., 165, Great Dover-street, London, S.E. 1.—Catalogue of forged steel boiler mountings and valves for high pressures and temperatures.

J. J. Griffin and Sons, Ltd., Kemble-street, Kingsway, W.C. 2.—List 8 X of small electric furnaces for small tool hardening, enamelling and general laboratory work.

C. A. Vandervell and Co., Ltd., Acton, London, W. 3.—Catalogue on the compensated voltage control system of public vehicle lighting; also a battery replacement chart for use in garages and motor works.

The New Conveyor Company, Ltd., Brooke-street, Smethwick, Staffs.—Brochure dealing in ten sections with mechanical handling equipment for power-houses, gasworks, cement works, quarries, docks, &c.

Duncan Stewart and Co., Ltd., London-road Ironworks, Glasgow.—Latest catalogue divided into sections, as follows:—Section 1, "Billet, Plate and Slab Shears"; Section 2, "Tyre and Wheel-making Machinery"; Section 3, "Improvements for Adaptation to Existing Rolling Mills."

Scholarships in Naval Architecture.—The Institution of Naval Architects announces that the following scholarships in naval architecture will be offered for competition in 1928:—(*a*) The Elgar Scholarship, £130 per annum, and (*b*) the John Samuel White Scholarship, £100 per annum. These scholarships are tenable at Glasgow University, four years; Durham University, Armstrong College, three years; Liverpool University, three years; Royal Naval College, Greenwich, three years. They are open to British apprentices or students who have not yet entered upon a university course. Full particulars may be obtained from the secretary, Institution of Naval Architects, 5, Adelphi-terrace, London, W.C. 2.

The Williams Prize of the Iron and Steel Institute.—On his retirement from the honorary treasurership of the Iron and Steel Institute in 1926, Mr. Iiltyd Williams founded the "Williams Prize," intended especially to encourage men on the technical staffs of iron and steel works in the United Kingdom and the Dominions to offer to the Institute papers of a practical character. The Council has now made the first award of this prize, and the money available has been divided as follows:—To Mr. E. A. Atkins (Messrs. Ryland Bros., Warrington), the sum of fifty guineas, for his paper on "The Drawing of Steel Wire and its Relation to the Qualities of Steel" (May, 1927); and to Mr. C. S. Gill (Consett Iron Company), the sum of thirty guineas for his paper on "The Effect of Ash in the Coke on Blast-furnace Working" (September, 1927).

Portrait of Professor J. A. Fleming, F.R.S.—The portrait of Professor J. A. Fleming, painted by Sir William Orpen, R.A., will be presented to University College, London, on Wednesday, November 30th, at 5 p.m. The presentation will be made by the chairman of the Fleming Portrait Fund Committee, Mr. A. A. Campbell Swinton, and will be received on behalf of the College by the chairman of the College Committee, the Viscount Chelmsford, and the Dean of the Faculty of Engineering, Professor E. G. Coker. Mr. Campbell Swinton will also present to Professor Fleming a copy of the portrait. Professor Fleming has intimated his intention of presenting this copy to the Institution of Electrical Engineers. Tickets for the presentation ceremony at University College on November 30th may be obtained by sending a stamped addressed envelope to the assistant secretary of the College.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. Coast—	
Native	18/6 to 21/-
(1) Spanish	18/6 to 21/-
(1) N. African	18/6 to 21/-
N.E. Coast—	
Native	18/- to 21/-
Foreign (c.i.f.)	21/-

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) Scotland—		
Hematite	3 16 0	—
No. 1 Foundry	3 17 6	—
No. 3 Foundry	3 12 6	—
N.E. Coast—		
Hematite Mixed Nos.	3 11 6	3 11 6
No. 1	3 12 0	3 12 6
Cleveland—		
No. 1	3 10 0	3 7 6
Silicious Iron	3 10 0	3 7 6
No. 3 G.M.B.	3 7 6	3 5 0
No. 4 Foundry	3 6 6	3 4 0
No. 4 Forge	3 6 0	3 3 6
Mottled	3 5 6	3 3 0
White	3 5 6	3 3 0
Midlands—		
(3) Staffs.—		
All-mine (Cold Blast)	—	—
North Staffs. Forge	—	—
„ „ Foundry	3 6 0	—
(3) Northampton—		
Foundry No. 3	3 0 6 to 3 1 0	
Forge	2 15 0	—
(3) Derbyshire—		
No. 3 Foundry	3 5 6 to 3 6 0	
Forge	3 2 6	—
(3) Lincolnshire—		
No. 3 Foundry	3 4 0 to 3 5 0	
No. 4 Forge	3 2 6	—
Basic	3 2 6	—
(4) N.W. Coast—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 6 6 (a); 4 9 6 (b); 4 13 0 (c)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
Scotland—		
Crown Bars	10 15 0	10 5 0
Best	—	—
N.E. Coast—		
Iron Rivets	11 15 0	—
Common Bars	10 15 0	—
Best Bars	11 5 0	—
Lancs.—		
Crown Bars	10 0 0	—
Second Quality Bars	9 10 0	—
Hoops	12 10 0	—
S. Yorks.—		
Crown Bars	11 0 0	—
Best Bars	12 5 0	—
Hoops	12 10 0	—
Midlands—		
Crown Bars	9 12 6 to 10 0 0	
Marked Bars (Staffs.)	13 0 0	—
Nut and Bolt Bars	9 0 0 to 9 5 0	
Gas Tube Strip	11 10 0	—

STEEL. (d)

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) Scotland—		
Boiler Plates	10 10 0	10 10 0
Ship Plates, ½in. and up	8 2 6	7 12 6
Sections	7 12 6	7 2 6
Steel Sheets, ⅛in.	8 15 0 to 8 17 6	8 15 0
Sheets (Gal. Cor. 24 B.G.)	14 5 0	£13 15 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. Coast—		
Ship Plates	8 2 6	—
Angles	7 12 6	—
Boiler Plates	12 10 0	—
Joists	7 12 6	—
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5
Hard Billets	8 12 6	—
Soft Billets	7 12 6	—
N.W. Coast—		
Barrow—		
Heavy Rails	8 5 0	—
Light Rails	8 10 0 to 8 15 0	
Billets	7 10 0 to 10 0 0	
Manchester—		
Bars (Round)	8 10 0	—
„ (Small Round)	7 12 6	—
Hoops (Baling)	10 5 0	10 0 0
„ (Soft Steel)	9 0 0	8 15 0
Plates	8 7 6	—
„ (Lancs. Boiler)	10 10 0	—
Sheffield—		
Siemens Acid Billets	10 0 0	—
Hard Basic	7 12 6 to 8 2 6	
Intermediate Basic	7 10 0	—
Soft Basic	7 0 0	—
Hoops	10 0 0 to 10 10 0	
Soft Wire Rods	9 5 0	—
Midlands—		
Small Rolled Bars	7 12 6 to 8 0 0	
Billets and Sheet Bars	6 5 0	—
Sheets (20 W.G.)	11 10 0 to 12 0 0	
Galv. Sheets, f.o.b. L'pool	13 10 0 to 14 0 0	
Angles	7 12 6	—
Joists	7 12 6	—
Tees	8 12 6	—
Bridge and Tank Plates	8 7 6	—
Boiler Plates	11 0 0 to 11 10 0	

NON-FERROUS METALS.

Swansea—	
Tin-plates, I.C., 20 by 14	17/9 to 18/-
Block Tin (cash)	261 17 6
„ (three months)	256 5 0
Copper (cash)	59 1 3
„ (three months)	59 1 3
Spanish Lead (cash)	20 13 9
„ (three months)	21 3 9
Spelter (cash)	26 0 0
„ (three months)	25 15 0
Manchester—	
Copper, Best Selected Ingots	64 7 6
„ Electrolytic	64 10 0
„ Strong Sheets	88 0 0
„ Tubes (Basis Price), lb.	0 1 0½
Brass Tubes (Basis Price), lb.	0 0 11½
„ Condenser, lb.	0 1 1½
Lead, English	22 5 0
„ Foreign	21 7 6
Spelter	26 5 0
Aluminium (per ton)	£107

FERRO ALLOYS.

	Per Ton	Per Unit.
Tungsten Metal Powder	1/8 per lb.	
Ferro Tungsten	1/3 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£23 0 0	7/6
„ „ 6 p.c. to 8 p.c. „	£22 17 6	7/3
„ „ 8 p.c. to 10 p.c. „	£22 10 0	6/6
„ „ Specially Refined		
„ „ Max. 2 p.c. carbon	£36 0 0	11/6
„ „ „ 1 p.c. carbon	£41 10 0	15/-
„ „ „ 0·70 p.c. carbon	£53 0 0	17/6
„ „ „ carbon free	1/4 per lb.	
Metallic Chromium	3/- per lb.	
Ferro Manganese (per ton)	£12 0 0 for home, £16 for export	
„ Silicon, 45 p.c. to 50 p.c.	£12 15 0 scale 5/- per unit	
„ „ 75 p.c.	£20 5 0 scale 6/- per unit	
„ Vanadium	14/3 per lb.	
„ Molybdenum	5/- per lb.	
„ Titanium (carbon free)	0/11½ per lb.	
Nickel (per ton)	£170	
Ferro-Cobalt	9/3 per lb.	

FUELS.

SCOTLAND.
(Prices not stable.)

	Export.
Lanarkshire—	
(f.o.b. Glasgow)—Steam	13/3
„ „ Ell	13/9
„ „ Splint	15/- to 17/-
„ „ Trebles	14/6
„ „ Doubles	13/6 to 13/9
„ „ Singles	11/- to 11/6
Ayrshire—	
(f.o.b. Ports)—Steam	13/6
„ „ Jewel	15/6
„ „ Trebles	14/9
Fifeshire—	
(f.o.b. Methil or Burntisland)—Steam	12/- to 13/-
Screened Navigation	18/-
Trebles	14/9 to 16/6
Doubles	13/9
Singles	11/- to 11/3
Lothians—	
(f.o.b. Leith)—Best Steam	12/9 to 13/-
Secondary Steam	12/- to 12/3
Trebles	14/9
Doubles	14/-
Singles	10/9

ENGLAND.

(8) N.W. Coast—	
Steams	24/- to 25/-
Household	40/- to 56/-
Coke	22/6 to 23/6
Northumberland—	
Best Steams	13/6 to 14/-
Second Steams	12/9 to 13/-
Steam Smalls	9/- to 10/-
Unscreened	13/- to 13/6
Household	21/- to 27/-
Durham—	
Best Gas	15/6 to 16/-
Second	13/3 to 14/-
Household	21/- to 27/-
Foundry Coke	19/- to 26/-
Sheffield—	Inland.
Best Hand-picked Branch	28/- to 30/6 —
Derbyshire Best Bright House	23/- to 24/- —
Best House Coal	22/6 to 23/- —
Screened House Coal	19/- to 20/- —
„ „ Nuts	16/- to 17/6 —
Yorkshire Hards	14/6 to 16/6 —
Derbyshire Hards	15/- to 17/- —
Rough Slacks	8/6 to 9/6 —
Nutty Slacks	6/- to 7/- —
Smalls	3/- to 4/6 —
Blast-furnace Coke (Inland)	13/- at ovens —
Furnace and Foundry Coke (Export), f.o.b.	18/- to 19/-

(9) SOUTH WALES.

Cardiff—	
Steam Coals:	
Best Smokeless Large	19/- to 20/-
Second Smokeless Large	18/6 to 19/-
Best Dry Large	18/3 to 18/9
Ordinary Dry Large	17/6 to 18/-
Best Black Vein Large	17/9 to 18/-
Western Valley Large	17/6 to 17/9
Best Eastern Valley Large	17/- to 17/6
Ordinary Eastern Valley Large	16/9 to 17/-
Best Steam Smalls	12/6 to 13/-
Ordinary Smalls	11/- to 12/6
Washed Nuts	18/- to 20/6
No. 3 Rhondda Large	19/6 to 20/-
„ „ Smalls	15/6 to 16/6
No. 2 „ Large	16/- to 16/6
„ „ Through	14/6 to 15/6
„ „ Smalls	12/6 to 13/6
Foundry Coke (export)	30/- to 37/6
Furnace Coke (export)	27/6 to 30/-
Patent Fuel	22/6 to 24/3
Pitwood (ex ship)	27/9 to 28/-
Swansea—	
Anthracite Coals:	
Best Big Vein Large	34/- to 36/-
Seconds	27/6 to 30/-
Red Vein	20/6 to 26/-
Machine-made Cobbles	36/6 to 40/6
Nuts	40/- to 45/-
Beans	24/6 to 28/6
Peas	17/- to 19/-
Breaker Duff	8/6 to 9/-
Rubbly Culm	7/9 to 8/-
Steam Coals:	
Large	18/- to 19/-
Seconds	16/6 to 17/-
Smalls	10/6 to 11/6
Cargo Through	15/6 to 16/-

(1) Delivered. (2) Net Makers' works. (3) f.o.t. Makers' works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (a) Delivered Glasgow. (b) Delivered Sheffield. (c) Delivered Birmingham. (d) Rebate 7/6 joists and 5/- all other materials if home consumers confine purchases solely to British products.

French Engineering Notes.

(From our Correspondent in Paris.)

The Steel Trade.

A FEATURE of the week has been a slight improvement in the export demand for iron and steel on the Brussels Exchange, and prices have hardened, and as buying in France is a little more active, it is assumed that consumers no longer find it advisable to hold off the market in the hope of a further reduction in prices. There is no indication that this small improvement will develop into an early recovery, for the situation generally remains unsatisfactory, and all that can be said is that prices have touched their lowest level. An instance of this is that merchant bars on the Brussels Exchange have advanced 3s. per ton to £4 16s. since the beginning of October ; angle sections are now £4 15s. and rods £5 2s. 6d. to £5 3s. per ton. Girders, however, have declined. So far as the home demand is concerned there is little hope of its growing to any extent for some time to come. Not only are public undertakings making slow headway, but the country's purchasing power has been reduced considerably, and it is difficult to see how the outlook can improve until the situation becomes more stabilised.

The Trans-Saharan Railway.

Several Chambers of Commerce have passed resolutions urging upon the Government to lose no time in building the railway across the Sahara Desert, which is to connect up the African Colonies directly with the Mother Country. The Roubaix Chamber of Commerce has now made a further plea in favour of the immediate construction of the railway on the ground that the position of the cotton spinning industry in that district has become very precarious, and that the future is regarded with considerable anxiety. It urges that the industry can only be saved by the production of cotton in the Niger Valley and by the building of a railway which will bring the source of supply within eight days of the cotton mills. The railway, it is claimed, will permit of colonial produce being distributed by purely French routes, and, while welding up the African Colonies with France in one vast Empire, will be of inestimable value for national defence. The Roubaix Chamber of Commerce further adds that with the facilities offered by the Dawes agreement for obtaining reparations from Germany that country would supply a large part of the material required for the construction of the railway, so that the financial difficulties do not appear to be so serious as to prevent the work being put in hand without delay.

Reparations.

The carrying out of public works implies the use of material supplied by Germany on account of reparations, for in the present state of national finance it would be impossible otherwise to carry them out at all. In the year ending 1926 the value of material and goods obtained from Germany for reparations was 2500 million francs. During the past year the Government did not take the quantity of goods it was entitled to for reparations, because the situation was complicated by the high production costs in Germany. At the time of the coal shortage the Government obtained from that country considerable quantities of coal and coke which it sold to industrial consumers at below cost. It is impossible to do that now, and the material must either be employed for public works carried out for the State or else sold to others at a profit. On account of the higher prices of the German material no one is inclined to purchase, so that the greater part of it must be used for public works, but here again there are difficulties arising from the claims of French manufacturers to receive orders equal in value to those sent to Germany, while the fact of obtaining material for reparations implies an expenditure for the execution of works which the State cannot always entertain.

Trade Prohibitions.

An immediate result of the Geneva Conference on the abolition of prohibitions has been the suppression of licences for the importation of coal into France, as well as the removal of restrictions upon exports. This has been done after negotiations with Germany, which country has undertaken to accept 350,000 tons of coal from the Moselle. The arrangement is favourable to the North-Eastern coalfield, which is unable otherwise to dispose of a heavy accumulation of fuel, and it also provides an excuse for the suppression of import licences that have failed to give the results expected of them. The French coalowners are no better off, because they cannot sell coal at prices that will stimulate consumption, and consumers complain that there can be no industrial improvement until they can obtain cheaper coal. During the conflict last year with the colliers the Government induced the coalowners to withdraw their proposed cut in wages by a promise that everything would be done to allow of their selling fuel at profitable prices. A propaganda was carried out in favour of French coal, the importation of foreign coal was prohibited except by licence, and arrangements were made to facilitate the transport of French fuel to all the consuming centres. The result has been detrimental to the interests of consumers, who insist on being allowed to purchase the cheaper and generally better foreign coal.

Liquid Fuel Supplies.

A report has been issued by the Office National de Combustibles Liquides upon the results of the policy which has been pursued during the past three years for relieving France of its dependence upon foreign supplies of liquid fuel. The sources are, of course, mainly foreign, but French interests have been largely increased in European and Asiatic oilfields, and the construction of tankers is enabling France to procure a large part of her own liquid fuels, whereby she has already a certain independence. The prospecting for oil in France and the Colonies has not so far given any tangible result, except to reveal the existence of an oilfield in the Hérault, the importance of which has yet to be proved, but prospecting work continues to be carried out wherever there appear to be indications of oil-bearing territory.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

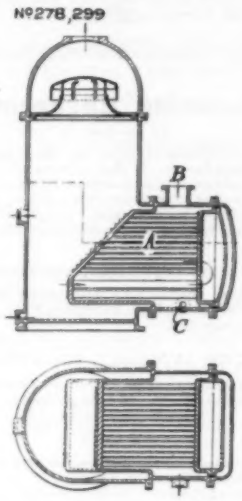
Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application ; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

CONDENSERS AND FEED-WATER HEATERS.

278,299. June 29th, 1926.—EVAPORATORS, H. Hillier, 3, Central-buildings, Westminster.

In this evaporator the liquid to be evaporated passes through the inside of the nest of tubes A, while the heating steam is admitted to the shell at B and the condensate is drawn off at C. A circulation of the liquid through the tubes is, according to the

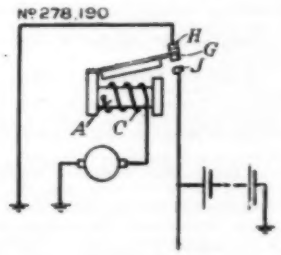


inventor, ensured by the difference in the density of the evaporated and unevaporated liquid. The circulation is from left to right in the lower tubes and in the opposite direction above. In order to equalise the flow through the several tiers of tubes they are stepped in length as shown in the drawing.—*September 29th*, 1927.

SWITCHGEAR.

278,190. October 20th, 1926.—AUTOMATIC SWITCHES, The C.L.I. Manufacturing Company, Limited, 116, Colmore-row, Birmingham ; E. A. Watson and J. A. Laird, Victoria Works, West Orchard, Coventry.

With this switch or cut-out, when the generator is at rest the armature is in the open position as shown, and the circuit containing the generator only is closed through the fixed contact H. When, after the generator has been started, the current reaches a predetermined value, the electro-magnet A pulls the free end of the armature towards the adjacent pole piece, thereby separating the movable contact G from the first fixed contact H and causing

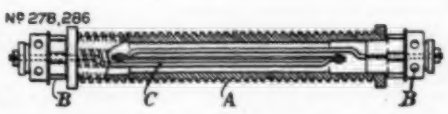


it to abut on the second fixed contact J. Current now flows from the generator to the battery through the winding C. If the core of the electro-magnet were made of soft iron the interruption of the first circuit would merely have the effect of vibrating the armature, and the latter would not be pulled over into the position for closing the second circuit, but by employing in the magnet core a steel capable of retaining a sufficient amount of magnetism to hold the armature in the closed position after the exciting current is interrupted, the required change over from one circuit to the other can be effected satisfactorily. Obviously the armature, instead of the core, may be made of hard steel.—*October 6th*, 1927.

ELECTRICAL APPLIANCES.

278,286. June 15th, 1927.—HEATING ELEMENTS, H. H. Berry, 86, Newman-street, London, W. 1.

For the purposes of convenience in manufacture and in order to make the heating elements of electric fires readily adaptable

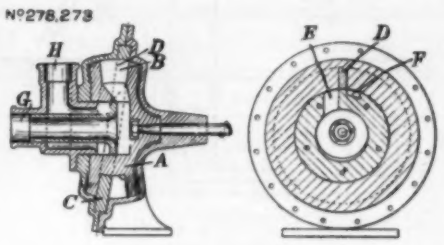


to different sizes of apparatus the refractory core is made of three separate pieces. There is the central grooved part A, on which the heating wire is wound, and two end pieces B B for carrying the terminals. The end pieces can be associated with central portions of any convenient length. The two end pieces are held together by a bimetallic strip C which shortens on being heated and consequently holds the assembly together tightly even if the refractory parts are broken.—*October 6th*, 1927.

PUMPING AND BLOWING MACHINERY.

278,273. April 23rd, 1927.—ROTARY PUMPS, A. T. Macleay, 4, Craiglea Drive, Edinburgh.

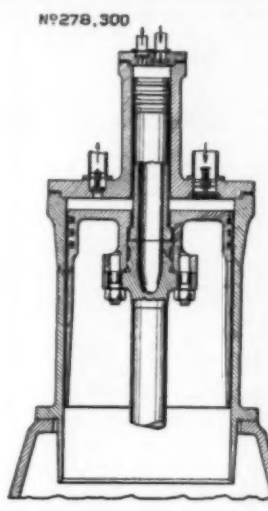
This machine may be used either as a pump or a motor. It comprises a rotor A having an annular chamber B. In this annulus there is a ring C which revolves in a groove in the casing. It is driven by a blade or paddle D fixed in the rotor and passing



through a slot in the ring. On either side of the blade there are ports E and F in the hub of the rotor, which communicate with the branch pipes G and H. As the rotor revolves the disc moves, relatively to the conical faces of the rotor, and sweeps out the contents of the annular chamber through the appropriate port. The machine is, of course, reversible.—*October 6th*, 1927.

278,300. August 22nd, 1927.—PISTONS FOR TANDEM COMPOUND COMPRESSORS, C. Schaer, Langenthal, Switzerland.

This invention relates to a piston construction for tandem compound compressors, and has for its object to provide a construction which facilitates the alignment of the two pistons and obviates the risk of damage due to the loosening of parts such as connecting bolts projecting into the compression space. Accord-

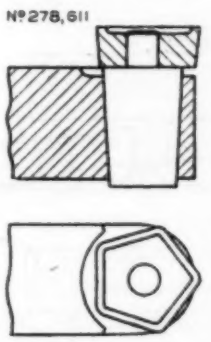


ingly the connection between the low-pressure piston and the high-pressure piston is such as to allow relative movement in the lateral direction between the parts while, when disconnected, the smaller piston can be withdrawn through the larger piston, the nature of the connection obviating the use of separate parts, such as bolts or nuts within the compression space.—*October 6th*, 1927.

MACHINE TOOLS AND SHOP APPLIANCES.

278,611. April 29th, 1927.—A HIGH-SPEED TURNING TOOL, Siemens-Schuckertwerke Gesellschaft mit beschrankter Haftung, Berlin-Siemensstadt, Germany, and C.W. Drescher, 15, Herkules Ufer, Berlin, Germany.

This invention, it is claimed, solves the problem of producing an exceedingly favourable shape of cutting tool with a hitherto



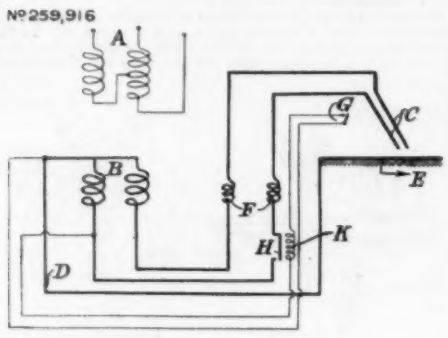
unattained minimum consumption of expensive high-grade material. The tool has closed cutting edges and is characterised by the fact that the cutter proper consists of a high-grade material and is carried by a pin of low-grade material, and by the fact that along the cutting edges there runs a narrow surface strip which encloses a sunk or recessed surface as shown in the illustration.—*October 13th*, 1927.

WELDING.

259,916. June 7th, 1926.—IMPROVEMENTS IN OR RELATING TO WELDING OR CUTTING BY THE ELECTRIC ARC, Société Alsacienne de Constructions Mecaniques, of Mulhouse (Haut Rhin), France.

This specification describes a two-phase arc welding system.

The current is drawn from a three-phase supply, the primary windings A of the transformers being connected Scott fashion. The two-phase currents are induced in the secondary windings B, which feed electrodes C. The secondary windings have a common pole connected through a conductor D to the part E, which supports the work to be welded. Inductances F serve to limit the current on striking the arc, and to help to ensure

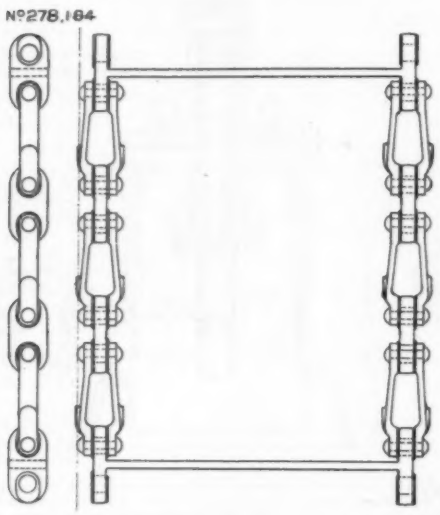


steadiness of operation. For preventing a single-phase arc forming between the two electrodes when they are removed from the work, an arrangement is employed which permits the electrodes to be cut out as soon as the arc leaves the work. A switch G is embodied in the electrode holder, and the circuit breaker H can be actuated through the medium of the coil K, by operating this switch.—*October 7th*, 1927.

CRANES AND CONVEYORS.

278,184. October 12th, 1926.—Conveyor Chains, R. Watson, Corporation Gasworks, Doncaster; and Ride and Bell, Ltd., Misterton, Notts.

The inventors say that there is a liability for the chains of conveyors to stretch unevenly and to get out of line with the driving sprockets, so that the teeth do not readily enter the usual

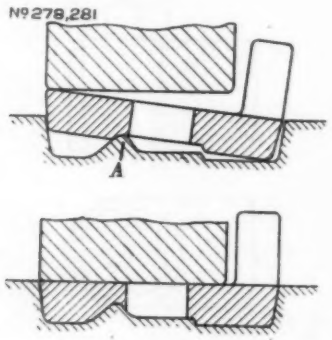


rectangular openings in the chains and the machine may be wrecked. As a consequence they make the openings of the tapered form shown and recommend that the larger part of the hole should be towards the leading end of the conveyor.—*October 6th*, 1927.

TRAMWAYS AND RAILWAYS.

278,281. May 18th, 1927.—Salving Railway Fish-plates, M. Muller, 14, Allecstrasse, Hanover, Germany.

This invention is concerned with the salving or renovation of fish-plates, the edges of which have been so worn in service that they do not fit satisfactorily between the top and bottom flanges

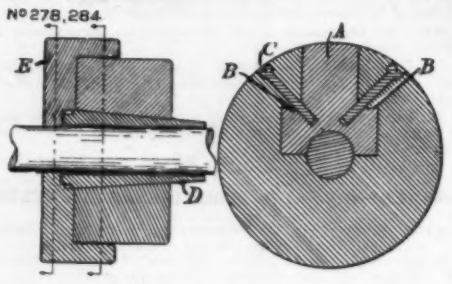


of the rails. The inventor presses the plates between dies of the form shown in the drawings, presumably in a hot condition. The peculiar feature of the dies is the projection or hump A, which, it is claimed, makes the metal of the plate spread out to fit the die without appreciably affecting the size of the bolt holes.—*October 6th*, 1927.

MISCELLANEOUS.

278,284. May 23rd, 1927.—Thrust Collars, W. T. Craig, Gowganda, Nipissing, Ontario.

One would gather that the object of this invention is to provide a thrust collar which can be slipped on to a shaft without a free end, although such an idea is not disclosed in the specification. The collar is a simple muff with a dovetailed slot for the passage of the shaft, which is filled by the closing block A. On account of the dovetail form of the faces B B it is claimed that centrifugal



force does not tend to split the collar. The closing block is held in place longitudinally by set screws C. The whole device is secured on the shaft by forcing in the taper sleeve D by means of the screwed cap E.—*October 6th*, 1927.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY AND SATURDAY, NOVEMBER 19TH.

Public Works, Roads and Transport Exhibition and Congress.—Agricultural Hall, Islington, N. 1. For programme of Congress see page 520.

TO-DAY TO SATURDAY, NOVEMBER 26TH.

International Commercial Motor Transport Exhibition.—Olympia, London, W. 14. 10 a.m. each day.

TO-DAY.

Chemical Engineering Group.—Chemical Society's Rooms, Burlington House, Piccadilly, London, W. 1. Paper, "Some Modern Methods of Recovery of Lubricating Oils," by Mr. A. J. Broughall. 8 p.m.

Institution of Locomotive Engineers: North-East Centre.—Hotel Metropole, Leeds. Paper, "Locomotive Engine Failures, with Some Hints for their Prevention," by Mr. H. J. Stephenson. 7 p.m.

Institution of Mechanical Engineers.—Storey's-gate, Westminster, London, S.W. 1. Paper, "Modern Portland Cement Plant," by Mr. Hal Gutteridge. 6 p.m.

Junior Institution of Engineers.—Caxton Hall, Westminster, London, S.W. 1. Presidential address, "The Nile and the Use of its Waters," by Sir Murdoch Macdonald. 7.30 p.m.

SATURDAY, NOVEMBER 19TH.

Institution of British Foundrymen: Lancashire Branch, Junior Section.—Visit to the Metallurgical Laboratories at the Manchester University. 3 p.m.

MONDAY, NOVEMBER 21ST.

Institution of Mechanical Engineers.—Storey's-gate, Westminster, London, S.W. 1. Graduates' Section meeting. "The Locomotive Boiler in Service," by Mr. G. K. Wood. 6.30 p.m.

Royal Society of Arts.—John-street, Adelphi, London, W.C. 2. Cantor Lecture, "Alloy Steels, their Manufacture, Properties and Uses," by Professor H. C. H. Carpenter. 8 p.m.

TUESDAY, NOVEMBER 22ND.

Chadwick Public Lecture.—Lecture Hall, Royal Society of Arts. "The History of Housing: No. 2, Housing, 1885 to 1927," by Major Harry Barnes, F.R.I.B.A. 8.15 p.m. Admission free.

Illuminating Engineering Society.—E.L.M.A. Lighting Service Bureau, 15, Savoy-street, London, W.C. 2. Opening meeting of the session. 7 p.m.

Institution of Automobile Engineers.—Institution of Electrical Engineers, Savoy-place, Victoria Embankment, London, W.C. 2. Joint meeting with the Institute of Transport. Paper, "Military Transport Vehicles: Recent Developments and their Commercial Significance," by Captain C. H. Kuhne. 8 p.m.

Institution of Engineers and Shipbuilders in Scotland.—39, Elmbank-crescent, Glasgow. Paper, "The Uses of Nickel Deposits for Engineering Purposes," by Mr. C. H. Faris. 7.30 p.m.

Royal Institution of Great Britain.—21, Albemarle-street, London, W. 1. "A Year's Work in X-ray Crystal Analysis," by Sir William Bragg. 5.15 p.m.

Society of Glass Technology.—Congregational School-room, Stourbridge. Lecture, "Modern Artistic Glass," by Professor W. E. S. Turner. 7.30 p.m.

WEDNESDAY, NOVEMBER 23RD.

Institution of Automobile Engineers.—Institution of Mechanical Engineers, Storey's-gate, Westminster, London, S.W. 1. Paper, "The Trend of Design in Motor Trucks and Motor Coaches for Fleet Operation," by Mr. H. L Horning. 7.45 p.m.

Institution of Automobile Engineers.—Birmingham Graduates' visit to the works of Joseph Lucas, Ltd., Great King-street, Birmingham. 2.30 p.m.

Institution of Automobile Engineers: North of England Centre.—The Engineers' Club, Albert-square, Manchester. Paper, "The Design and Development of the Compression-ignition Engine," by Mr. H. B. Taylor. 7 p.m.

Society of Glass Technology.—Talbot Hotel, Stourbridge. Luncheon at 1 p.m., followed by general meeting at 2.30 p.m.

WEDNESDAY AND THURSDAY, NOVEMBER 23RD AND 24TH.

Institute of Fuel.—Institution of Electrical Engineers Savoy-place, Victoria Embankment, London, W.C. 2. Annual meeting. 10.30 a.m. each day.

FRIDAY, NOVEMBER 25TH.

Diesel Engine Users Association.—Caxton Hall, Westminster, London, S.W. 1. Paper, "Centrifugal Castings for Diesel Engines," by Mr. J. E. Hurst.

Institution of Civil Engineers: Birmingham and District Association.—Chamber of Commerce, New-street, Birmingham. Paper, "Hams Hall Sidings," by Mr. H. Lorain Folkes. 6 p.m.

Institution of Engineering Inspection.—Royal Society of Arts, John-street, Adelphi, London, W.C. 2. Paper, "Elutriation as an Aid to Engineering Inspection," by Mr. L. Andrews. 7.30 p.m.

Institution of Locomotive Engineers: Manchester Centre.—College of Technology, Sackville-street, Manchester. Lecture, "Manufacture of the Various Types of Superheaters," by Mr. R. W. Whittle. 7 p.m.

Junior Institution of Engineers.—30, Victoria-street, London, S.W. 1. Lecturette, "A Talk about Pioneers in High-Pressure Steam," by Mr. Loftus P. Perkins. 7.30 p.m.

National Institute of Industrial Psychology.—Royal Society of Arts, 18, John-street, London, W.C. 2. "How Psychology Enters into the Institute's Factory Investigations." 5.30 p.m.

TUESDAY, NOVEMBER 29TH.

Institute of Metals: Birmingham Local Section.—The Engineers' Club, Waterloo-street, Birmingham. Paper, "Corrosion," by Dr. G. D. Bengough. 7 p.m.

WEDNESDAY, NOVEMBER 30TH.

Institution of Automobile Engineers.—Savoy Hotel, Strand, London, W.C. 2. Twenty-first anniversary dinner. 7 for 7.30 p.m.

FRIDAY, DECEMBER 2ND.

Institution of Mechanical Engineers.—Storey's-gate, Westminster, London, S.W. 1. "Cutting Tools Research Committee. Report on Cutting Temperatures: their Effect on Tools and on Materials Subjected to Work," by Mr. E. G. Herbert. 6 p.m.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

W. Rainforth and Sons, Ltd., of Monks-road, Lincoln, ask us to announce that they have acquired the sole manufacturing and selling rights of the "Polestar" system of refrigeration.

Hick-Hargreaves and Co., Ltd., of Bolton, ask us to announce that they have secured the British manufacturing rights of Masons valves with the patents, and are proceeding immediately to manufacture. The valve will be known as the "Hick-Mason" valve.

CONTRACTS.

Clayton Wagons, Ltd., of Lincoln, has received an order from Claypole Rural District Council for a latest improved 6-7-ton overtype steam wagon fitted with oil-draulically operated three-way tipping body.

Ransomes and Rapier, Ltd., of Ipswich, have recently received orders for:—(*a*) Sluices for installation in India from the Mewar Government (4), the Perak River Hydro Electric Power Company (3), the India Office (5). The same company has also received orders for cranes from Tata, Ltd., India, one 75-ton and one 20 ton steam breakdown cranes; Egyptian State Railways, one 40-ton steam breakdown crane and match truck; Air Ministry (5), Burma Oil Company, Ltd. (1), and Pickfords, Ltd. (1); for excavators from the Société Internationale Forestière et Minière du Congo, and from M. Chas. de Jonghe, Belgium; and for electric traversers and capstans from the India Office (East India Railway), and the Bengal-Nagpur Railway.

The Electric Furnace Company, Ltd., of 17, Victoria-street, London, S.W., has recently received orders for five Ajax-Wyatt furnaces for the Compagnie Générale des Métaux, Serrifontaine, France, and for two Ajax-Wyatt furnaces for the Société d'Electro-métallurgie de Dives. It has also just shipped six Ajax-Wyatt furnaces to the Tréfileries et Laminoirs du Havre, France. Each of these furnaces is of 600 lb. capacity, and is required for melting brass. The same company has also recently received an order for a 150 kVA Ajax-Northrup high-frequency furnace for steel melting from the Soc. Anon. Commentry-Fourchambault and Décazeville, Imphy, France, and is now erecting a similar furnace for the S.A. des Etablissements Jacob Holtzer, Unieux. These furnaces are each of 450 lb. capacity, and are to be used for melting steel.

Edgar Allen and Co., Ltd., of Sheffield, have recently received the following orders:—(*a*) From the Oxford and Shipton Cement, Ltd., for a plant for the production of 120,000 tons of Portland cement per annum at the new factory which is being erected in Oxfordshire; (*b*) through their agents, Noyes Bros. (Sydney), Ltd., from Southern Portland Cement, Ltd., for a Portland cement factory at Berrima, New South Wales, with a capacity of 120,000 tons per annum of high grade Portland and quick-hardening cement. The same firm has also got in hand the following additional contracts:—50,000-ton Portland cement plant for the Milburn Lime and Cement Co., Ltd., New Zealand; 35,000-ton Portland cement plant for the Barnstone Cement Co., Ltd., near Nottingham; 35,000-ton Portland cement plant for Mr. W. E. Benton, Chinnor, Oxfordshire; rotary cement kiln and auxiliary plant for the Sundon Works of the Associated Portland Cement Manufacturers, Ltd.

The Junior Institution of Engineers.—At the annual general meeting of the Institution held on Friday, November 11th, the following officers were elected for the session 1927-28: Chairman, W. M. Hurrell; vice-chairman, C. E. Atkinson and S. H. Hole; hon. treasurer, R. L. Kirlew; hon. librarian, P. L. Mullings; members of Council, E. Ambrose, H. S. Rentell, and R. D. West; junior member of Council (under twenty-six), B. J. Axten; honorary auditors, F. E. Henman, A. E. Knight, T. C. Morewood, and A. J. Wheeler.

Advanced Lectures in Mining.—Under the auspices of the University of London, a course of four lectures on "The Ventilation of Mines: Considered from the Engineering Standpoint," will be given at the Imperial College, Royal School of Mines, Prince Consort-road, South Kensington, S.W. 7, by Professor Henry Briggs, D.Sc., Ph.D., Hood Professor of Mining in the University of Edinburgh, at 5.30 p.m. on December 5th, 6th, 7th and 8th, 1927. Admission will be free, without ticket. Further particulars may be obtained on application to Mr. Edwin Deller, Academic Registrar, University of London, South Kensington, S.W. 7.